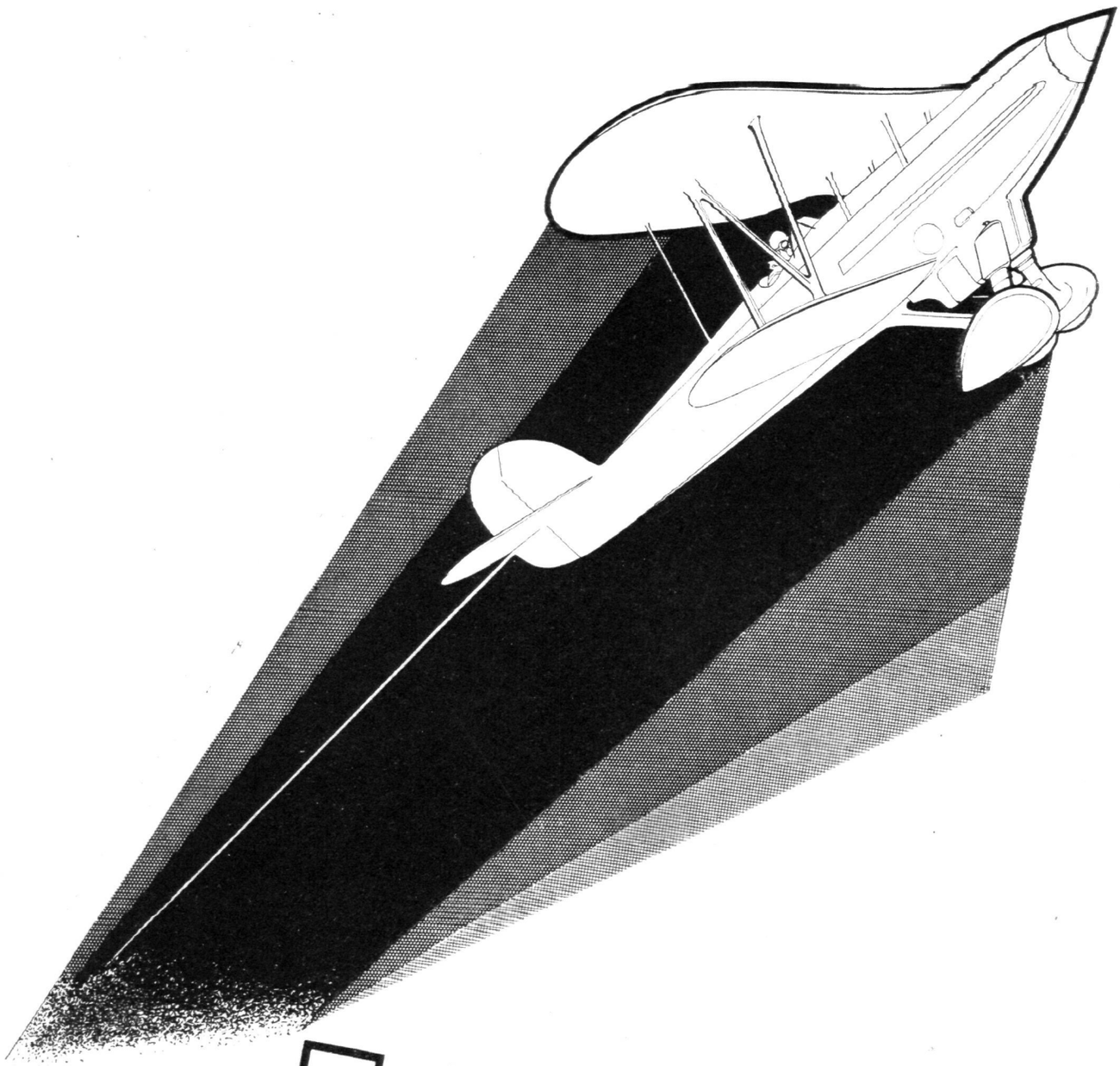
FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

No. 1305
Vol. XXV
No. 52

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

SIXPENCE
EVERY THURSDAY



FAIREY

HIGH-PERFORMANCE SERVICE AIRCRAFT

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 1305. (Vol. XXV. No. 52.) 25th Year. DECEMBER 28, 1933 Weekly, Price 6d. Post Free, 7½d. Abroad, 8d.

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C.2

Telephone: (2 lines), Holborn 3211 and 1884.

Telegrams: Truditur Westcent, London

Subscription Rates, Post Free.

UNITED KINGDOM	s.	d.	OTHER COUNTRIES	s.	d.
3 Months ..	8	3	3 Months ..	8	9
6 ,, ..	16	6	6 ,, ..	17	6
12 ,, ..	33	0	12 ,, ..	35	0

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1933.

Dec. 28. Irish Ae.C. Annual Dance, Gresham Hotel, Dublin.
Dec. 29. Liverpool and Dis. Ae.C. Annual Ball, Grosvenor Hotel, Chester.

1934.

Jan. 18. "Ethyl," Lecture by F. R. Banks, before R.Ae.S.
Jan. 19. Newcastle-on-Tyne Ae.C. Annual Ball, Barras Bridge Assembly Rooms.
Jan. 24. "Development of the Fleet Air Arm." Lecture by Wing Com. W. R. D. Acland, before R.U.S.I.
Jan. 30. Croydon Airport Annual Dinner and Dance.
Feb. 1. "Engine Cowlings." Lecture by J. D. North before R.Ae.S.
Feb. 2. Cinque Ports Flying Club Annual Dinner and Dance, Royal Pavilion Hotel, Folkestone.
Feb. 8. "Engines." Lecture by Capt. A. G. Forsyth before R.Ae.S.
Feb. 16. Bristol and Wessex Ae.C. Annual Ball, Grand Spa Hotel, Clifton.
Feb. 21. "Development of Aircraft and Its Influence on Air Operations." Lecture by Sq. Ldr. R. V. Goddard before R.U.S.I.
Feb. 22. Herts and Essex Ae.C. Annual Dinner and Dance, Wharncliffe Rooms, Hotel Gt. Central, London.
Mar. 15. "Some Developments in Aircraft Construction." Lecture by H. J. Pollard before R.Ae.S.
Mar. 21. "Some Problems of a Technical Service." Lecture by Wing Com. G. W. Williamson, before R.U.S.I.
Mar. 29. "Results from the Compressed-Air Tunnel." Lecture by E. F. Relf, before R.Ae.S.
Apr. 27-May 6. International Aero Show, Geneva.
May 27. Deutsch de la Meurthe Cup.
June 1. Entries close at 12 noon for London-Melbourne Race.
June 30. Royal Air Force Display, Hendon.
July 3-9. 4th International Congress for Applied Mechanics Cambridge.
July 21-22. French Grand Prix.
Oct. 20. England-Australia Race for MacRobertson Prize.

EDITORIAL COMMENT

A Backward Glance

TWELVE months ago, less one week, we set forth what we should like the New Year 1933 to bring to the flying world. Our desires included the capture of the long-distance record by Great Britain, a good showing by the Boulton and Paul mailplane, the extension of the Eastern airway from Karachi to Australia, an improvement in the Africa air service from the use of the "Atalanta" class of aeroplanes, the release of private flying from some of the ridiculous over-control which had afflicted it, and the selection for the Royal Air Force of a new type of night bomber and a new type of flying boat. It is interesting now to look back and see how many of our New Year wishes have been fulfilled.

On the whole, the year 1933 has not done us too badly. The Fairey long-range monoplane duly did what was expected of it and captured the long-distance record by flying non-stop for 5,341 miles. What did not enter into our thoughts at the end of last year was the sequel which followed. The French pilots, Codos and Rossi, wrested the record from us by flying 5,600 miles. We do not grudge it to them; they had a more modern type of machine than ours, and their flight was a very fine one. Still, it is pleasing to recall that for a period during 1933 Great Britain held the three main world's records, speed, height, and distance, even though before the year was out we retained none of the three. Italy now holds the speed record with 424 m.p.h., and the French have the altitude record with 44,819 ft. We may partially console ourselves by reflecting that for one nation to hold all these three records at the same time, even for a short time, is rather a unique distinction. At the close of the year no one nation is so supreme in the matter of air records as Great Britain was during the course of the year. We must not forget that a fourth record, which we also held, speed over a 100 kilometres in a closed circuit, has also now gone to Italy.

There have been some other fine flying performances during the year, in which Great Britain has had her share of credit. Notable among them have

been two flights, each by two Westland aeroplanes, over the summit of Everest, the highest mountain in the world. After very careful preparation these flights were carried out quite successfully and so completely according to plan that the feat appeared almost easy.

It might seem wearisome to recount all the long individual flights which have been made by the Mollisons and others. Unofficial records from place to place have only a limited interest when the latest success is only a few hours better than the one which it has beaten. It is, however, worth mentioning in a review of the year that an Avro 10 with a crew of four, with Mr. Ulm as chief pilot, has succeeded in flying from England to Australia in less than a week. That time does mark an advance on previous performances, and as it was an example of team work rather than a stunt by a much-enduring solo pilot, it really gives us a foretaste of what we may expect of commercial air transport in the not-distant future. A very great feat by the Italian Royal Air Force was the formation flight of Savoia flying boats led by Marshal Balbo across the North Atlantic to Chicago and back. The tour of Col. and Mrs. Lindbergh from America to Europe across the North Atlantic and back across the South Atlantic was also an event of the year, for it too was no mere stunt but a survey flight intended to explore the possibilities of an air mail service between Europe and America.

An accident prevented the fulfilment of our hopes regarding the Boulton and Paul mailplane. The machine was duly produced, and seemed to promise well. It was crashed when undergoing its trials at Martlesham, and so we have no official data on which to form an opinion as to what the machine might have done. The air service to Australia has not yet become an accomplished fact, but the route has been extended from Karachi to Singapore, which is a very considerable advance. There have been delays from political causes, and the position at the end of the year is that the Australian Government has made itself responsible for the section east of Singapore. The terms of the contract were published a few weeks ago and tenders have been invited. Imperial Airways have joined hands with Q.A.N.T.A.S. to form an Australian company which hopes to tender. We have every expectation that before many months have passed our mails will be flown right into the heart of Australia.

On the Africa airway the " Atalanta " aeroplanes duly went on service and, as we hoped, they improved the efficiency of the service. What was not foreseen a year ago was that the passenger traffic on the Northern sections grew so heavy that these nine-seaters could not cope with it, and some Handley Page 42-type machines had to be requisitioned. The Africa airway is now a distinct credit to the British Empire.

Our hopes for some of the new equipment of the Royal Air Force have been more than fulfilled. We hoped for a new night bomber to be chosen, and the choice has fallen on the Handley Page " Heyford." We hoped for one new type of flying boat, and actually three new types have been selected, the Short " Singapore," the Supermarine " Scapa," and the Blackburn " Perth." In addition, the Blackburn " Baffin " had been adopted as the new Torpedo-bomber, and the Gloster " Gauntlet " as the new day-and-night fighter. Other items which concerned the Royal Air Force were the 21st anniversary of the formation of the Royal Flying Corps; the partial re-equipment of the Fleet Air Arm with modern types, and the reorganisation of the units on carriers from flights into squadrons; the progress made in equipping cruisers and capital ships with catapult seaplanes; the re-equipment of certain squadrons of the Auxiliary Air Force with " Harts " for " Wapitis "; the formation of the Western Area and the Central Area in place of the Wessex and Oxford Bombing Areas; and the appointment of Air Chief Marshal Sir Edward Ellington as Chief of the Air Staff. Air Exercises were held as usual during the summer, in the course of which 2,600 hours were flown. It is interesting to note in this connection that during the Exercises the day-bomber squadrons put in most flying hours, the regular squadrons averaging 146 hr. per squadron and the Auxiliaries 185½ hr. per squadron. Coast Defence Exercises, in conjunction with the Royal Navy, were also held in September, and though they were elementary in form, they suggested various useful lessons. Quite a useful year for the Service!

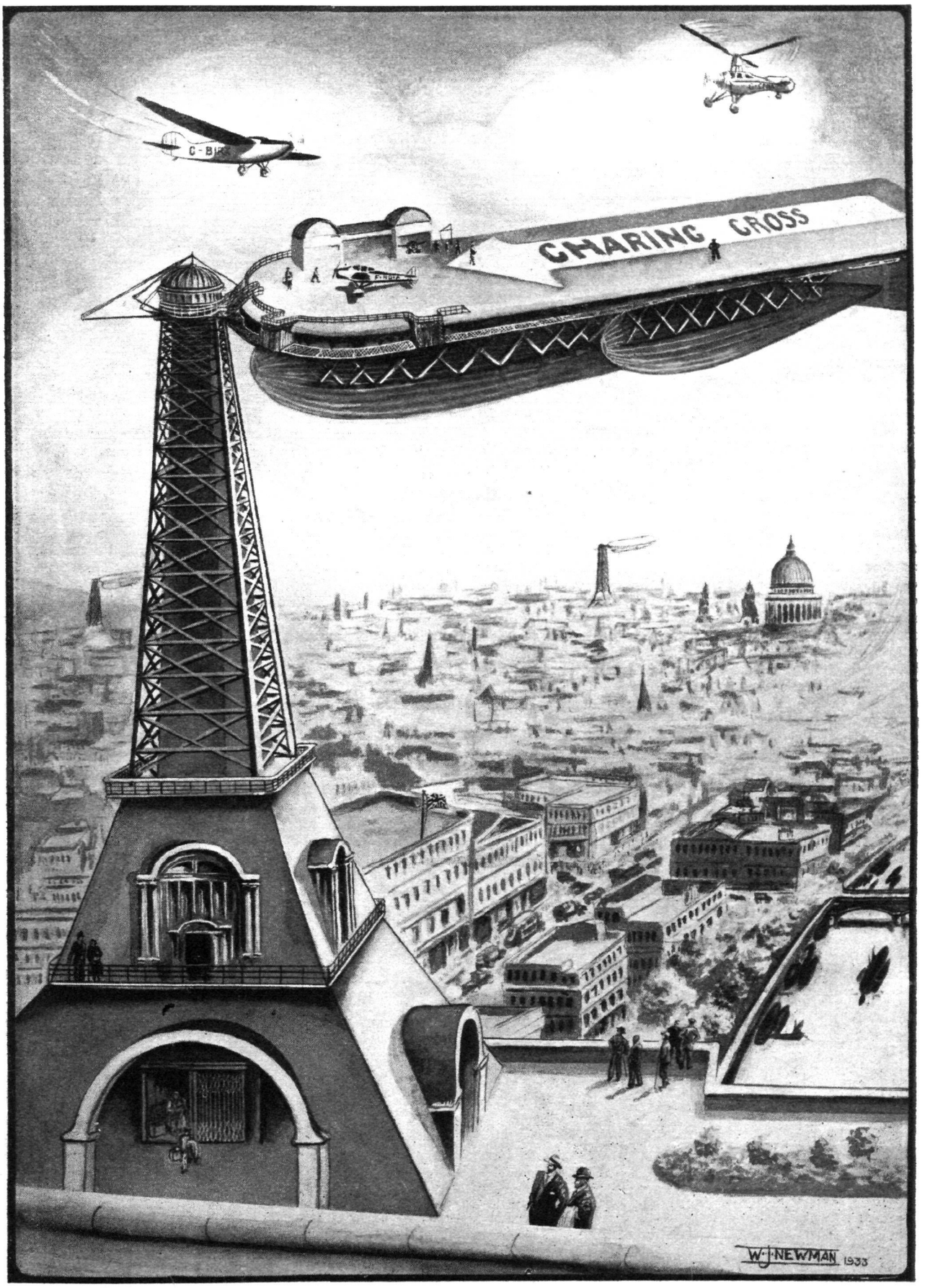
The year has seen the passing of a number of people whom the world of flying could ill spare. Among them we have to mourn Bert Hinkler, Miss Winifred Spooner, Mr. S. E. Saunders, Sir Henry Royce, Air Chief Marshal Sir Geoffrey Salmond, Maj. Cochran-Patrick, the Marquis de Pinedo, and Mr. Lowe-Wylde.

From the purely technical point of view the year 1933 has not been very notable. A number of new types of aeroplane were produced, and most of them were excellent in their own classes, but there have been no startling novelties. Perhaps the most interesting and significant technical event of the year has been the production of the direct-drive autogiro. The King's Cup was won by a new type, the D.H. " Leopard Moth," which has been designed as an improvement on the " Puss Moth." British designers have now begun to pay practical attention to retractile undercarriages, interesting examples being the Airspeed " Courier," the Comper " Mouse," and one type of Monospar.

For civil flying we wished a year ago freedom from over-control. Something has been done in the direction of setting this right, for the Secretary of State appointed the Gorell Committee to consider the question. We hope that the result will be some definite progress. Civil flying, however, has made some notable advances during the year. A very significant event was the inauguration by the Great Western Railway of an air line across the Bristol Channel. Others too have made a start with internal air lines, and the movement, though young, shows signs of considerable vigour. As a complement to this movement a conference was held at the Mansion House to place before the municipalities of the country the desirability of starting municipal landing grounds and airports. This conference was addressed in very striking terms by H.R.H. the Prince of Wales, who never espouses a cause without lending it great moral support.

A great compliment was paid to the safety of our great civil flying company, Imperial Airways, when the insurance interests agreed to insure a passenger for 1,000 miles flying a day at a premium of one shilling. Air survey has been less heard of than in some years, but the Air Survey Co. continues to do good work in India, and Major Hemming has secured a contract to prospect a large area in West Australia. So much for 1933!

A NEW USE FOR OLD AIRSHIPS



THE EFFECTS OF A GOOD CHRISTMAS HOLIDAY : A FLIGHT reader suggests that instead of large landing stages placed permanently over the Thames or over certain railway stations, airships anchored to mooring masts, and carrying platforms on their backs, might solve the problem of aerodromes in the centres of large cities.

TRANSPORTING CIRCUSES BY AIR

By CYRIL B. MILLS

Mr. Mills, a Director of Bertram Mills' Olympia Circus, is in charge of all the transport arrangements when the circus is on tour

CURIOSITY : A tiger, transported by Handley Page aeroplane from the Continent to Croydon to perform in the Bertram Mills Circus, is intrigued by the saxophone. *(Photo. reproduced by permission of The Central News.)*

THE old-time circus parade has practically vanished from our towns. Modern streets are too busy to spare the time for that old harlequinade of colour and gaiety, so reminiscent of a more leisured age. Well, the towns are the losers. The circus gains by the saving of several thousand pounds on the cost of elaborate free displays. But there is no need to be despondent, for, in my view, the opening circus procession, the joy of so many small boys, is certain to come back—*but next time it will be an aerial parade.*

I foresee the time, not so very far distant, when the first day of the circus show will be heralded by a fleet of gaily coloured aircraft and possibly dirigibles. They will, perhaps, fly low over the town distributing announcements of the show, and when over the circus "lot" perform a few graceful, daring "stunts." (I don't doubt that the circus troupe of the future will include several flying "aces.")

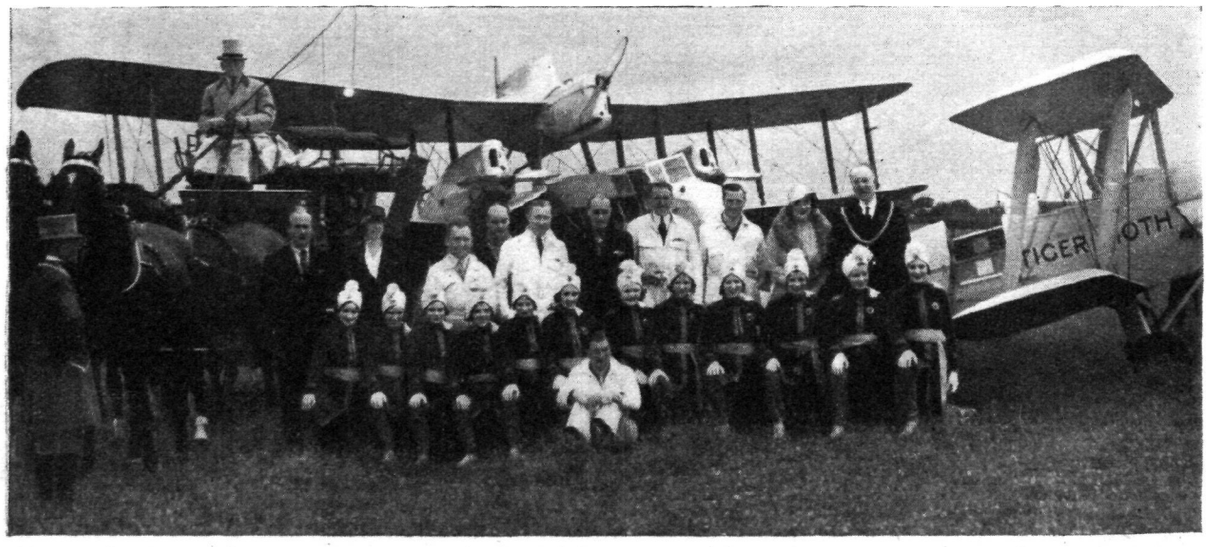
The machines, fitted, of course, with some helicopter device, will then land, and out of them will step the full circus procession of clowns, animals, strong men and acrobats, headed by a band leading them into the "big top," which, with all the rest of the circus gear, will have been landed earlier in the day by the squadron of goods-carrying aeroplanes.

Is this a fanciful prophecy? I don't think so. Already the aeroplane is used extensively in our business. As long ago as 1925 we transported the first fully-grown lion by aeroplane from the Continent to Olympia, much to the amazement of Imperial Airways officials. Every year since then some act or other has had to be conveyed to London by air, owing to special difficulties which would have meant that it could not otherwise have arrived in time.

But air travel has been of more use to us than merely an emergency method of transport. As soon as our six weeks' show at Olympia is over, we are off on our travels, searching all over the world for new "turns" and more daring feats. The winter circus season on the Continent lasts little more than two months, and in that time we have to visit every city of importance. This used to be found physically impossible in the old days, even by travelling every night and seeing shows every day. Many good "acts" were lost to us because we just had not time to see them. But the aeroplane, as you can well imagine, has been a real friend on that job. We are able to do in a few weeks what would take us months to do by rail and ship. And we are able to do it with a quarter the fatigue.

Yes, it is to the air that the showman of the future must look if he is to exist at all. As soon as ordinary commercial machines have been devised which will be able to carry cumbersome cargo, the circus proprietor will be the first to sense the tremendous advantage of air travel.

For transporting a big tenting circus, week in and week out, is no joke. To go by road demands a fleet of anything between five to fifty 6-ton lorries. Roundabout routes have very often to be taken, owing to bad road surfaces or low bridges, necessitating a stop in a town too small to be profitable. The whole business of packing up, transporting and unloading is done under terrific pressure,

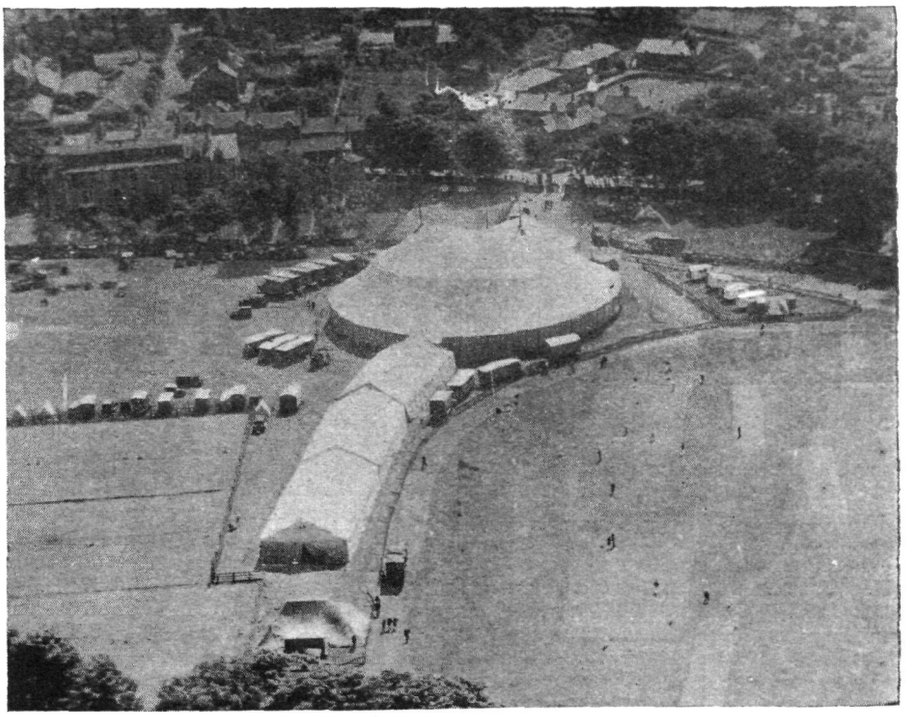


WHEN CIRCUSES MEET : Members of the Bertram Mills Circus and the Cobham "Aerial Circus" at Lancaster.

THE HAWKER "AUDAX" (Rolls-Royce "Kestrel"). A machine possessing all the qualities required for Army Co-operation work. Accurate manœuvrability through the whole speed range, a good climb and a high top speed.

"Flight" Photo.

THE " BIG TOP " FROM THE AIR : The Bertram Mills Circus at Lancaster.



regardless of labour costs. For there may be seventy miles to cover before the circus has to be pitched again for the next day's show. The aeroplane would save a great deal of that, by the speed with which the distance could be covered, thus giving extra time for the work at each end. It would be possible also to go far greater distances overnight, so that the most profitable time could be chosen to play in any town, almost regardless of its position.

Of course, to make this economically possible, it is essential that the circus should have its own fleet of aeroplanes. To have to transport the whole paraphernalia to an airport, and then load up, would be out of the question. It would also be necessary for the machines carrying the circus to rise and land almost vertically. For there is little room on a crowded circus " lot " for taking off and landing. However, I don't doubt that that is a development which will soon be perfected. And when that is satisfactorily accomplished, I know that the British showman will not be slow to make full use of the aeroplane both for transport and publicity purposes.

In America the aeroplane is up against somewhat stiffer competition. The railroads there have specially constructed trucks which make it possible to load 300-400 tons of material in half an hour, and the shows are therefore able to play in a different town every day without great difficulty. But I fancy that even there the great advantages of aerial transport will prevail in due course.

The circus, though it is one of the oldest forms of entertainment, depends for its very life on keeping up with the times and on making the fullest use of every new scientific development. The circus is going to make full use of the air when air travel has reached the necessary stage of convenience. And that day is now not far off.

TWO LIONS : The Napier variety is rather out of sight, but the Bertram Mills specimen has just alighted from the D.H. 34. This was as long ago as 1925. *(Photo. reproduced by permission of The Central News.)*

Air currents in the Bay of Gibraltar

A GEOPHYSICAL Memoir of the Meteorological Office states that, as a result of accidents to aircraft in lee of the Rock of Gibraltar, an experimental determination was made in 1929-30 of the distribution and violence of vertical air currents over the harbour and bay, using first the method of working by a model of the Rock (scale 1/5,000) in a wind tunnel at the National Physical Laboratory ; and later in the bay itself by full-scale work with balloons and theodolites, and a kite carrying a recording instrument.

It was found that the full-scale results obtained at Gibraltar had been closely forecast by the prior work with the model, and the conclusion followed that in other cases where the suitability of a proposed location for an aerodrome or seabase is to be considered, an examination of its probable wind troubles by means of a model would be advisable as a first step. In the present instance dangerous vortices, with very strong and extensive descending currents, were found, their distribution being mapped out in relation to the various directions of winds prevailing from day to day. With due east winds, for instance, two main vortices, more than half a mile in diameter, persisted over the harbour and adjacent parts of the bay, their curves axes ending vertically on the edge of the sea. With winds from the north or south of east the vortices turned their axes towards the horizontal and extended out for several miles over the bay. Within the vortices vertical currents were found which would reach 1,500 ft. per minute, up or down, in winds still within the limits of flying weather. Down currents were stronger than up currents, and were considerably more frequent.

Air Transport & Commerce

COMMERCIAL AVIATION IN DENMARK

IT was some fifteen years ago that the question of Danish air traffic was first considered, when a number of prominent representatives of Danish industry, shipping, commerce and banking, "got together" to study in which way it would be possible to establish commercial aviation in Denmark. In the spring of 1919 a commission was arranged to consider the whole question, and as a result the following spring saw the formation of Det Danske Luftfartselskab A/S. (the Danish Air Traffic Co., Ltd.). This company is thus one of the oldest of the European air operating concerns, looking back as it can upon thirteen years of activity.

On commencing operations the company was confined to a comparatively limited number of activities. Commercial aviation was an entirely new departure, and the lack of experience taught the company many a valuable lesson. Negotiations were conducted between the company and the Danish Government with a view to the granting of a subsidy to help the company in its enterprise. The Government considered the question and acknowledged the importance of the new means of transport. In 1925 the company was granted a provisional yearly subsidy by the Danish State for four years, and at the same time the municipal authorities of Copenhagen showed interest by granting a subsidy for the same period. Both these subsidies were allowed over an additional period after the completion of the four years.

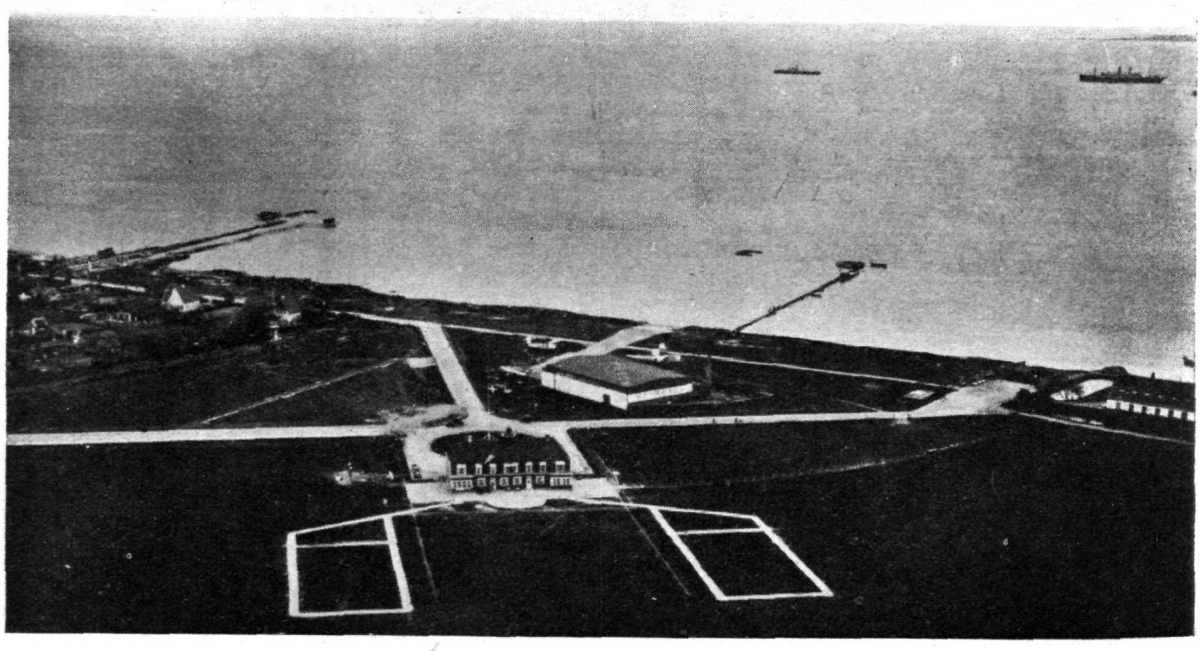
These subsidies enabled the company firmly to establish itself and to enlarge its field of operation. A regular season's timetable was arranged, partly by the company itself and partly in conjunction with foreign air traffic companies. At first the military aerodrome at Kloevermarken, in Copenhagen, constructed by the Government, was used by the company, but later operations were transferred to the airport at Kastrup, which was opened for commercial aviation in 1925. The Kastrup airport is situated on the eastern coast of Amager, and ranks amongst the finest airports in Europe. Besides being a Customs centre, it is a frontier airport, and consequently frontier police are to be found there. The equipment is quite up to date. An administration building on the northern side of the airport contains the departure and waiting rooms, the usual departments found at commercial aerodromes and the offices of the company. Two large hangars with workshops and fuel and oil supplies are on the aerodrome; for seaplanes a landing stage is provided. A wireless station and a very efficient meteorological service are also available on the eastern side of the airport. Facing the coast is a first-class modern hotel and restaurant for passengers. During the fine weather the inhabitants of Copenhagen use the restaurant for picnics while they watch the busy life at the airport, and joy flights over Copenhagen are made on Sundays and holidays. Besides giving many their "baptism of the air," these flights are good propaganda for the cause of air travel. The company operates the following lines on a "fifty-fifty" basis with the Deutsche Luft Hansa A/G.:—Malmoe-Copenhagen-Berlin, Malmoe-Copenhagen-Hamburg. During the summer months a service is operated between Copenhagen and Flensborg. The company also works with the Swedish A/B. Aerotransport in operating the night mail service on the Malmoe-Copenhagen-Hannover route.

The fleet of aircraft employed by the company consists of one Fokker FXII (three 465-h.p. Bristol "Jupiters"), three Fokker FVIIa ("Jupiters"), and one Desoutter monoplane ("Gipsy"). The FXII, which accommodates sixteen passengers, was built under licence by the Royal Navy Dockyard, and was delivered to the company in 1933. The FVIIa, which will carry eight passengers, was built in Holland. During 1932 the total distance flown by the company's machines was 261,525 km., of which 36,025 km. were flown on the night mail service.

The Copenhagen-Roedby Haven route has been supplied by the Danish Government with beacons and two emergency landing grounds for night flying aircraft.

Three new beacons were established during 1933, thus completing the night lighting of the Danish portion of the Copenhagen-Berlin air route. The three new lights were: that on the S.W. corner of the Island of Amager, Jernen on the peninsula south of Köge Bay, and Stuby near the southern coast of Zeeland, close to the city of Vordingborg. The chain of beacons now numbers seven, placed in a straight line from Kastrup airport to Rödbyhavn, where the air route leaves the Danish island of Lolland to cross the Baltic on its way to Germany.

An alternative route is provided which avoids crossing



COPENHAGEN'S AIRPORT: Kastrup Aerodrome, situated a short distance outside Copenhagen, also has facilities for seaplanes.

A Fokker F.XII (three Bristol " Jupiters ") used by D.D.L. (Danish Air Traffic Co.).

Köge Bay by going inland, a beacon being provided at Karlstrup, between the towns of Roskilde and Köge.

The beacons are of the flashing type, giving a flash every four seconds. With one exception, the beacons show white flashes. The only exception is that at Rödbyhavn, which shows white from 353 deg. through north to 83 deg. and red from 83 deg. through south to 353 deg.

A REPEAT ORDER FOR JUNKERS

THE last of the batch of 12 Junkers Ju.52 3/m. commercial monoplanes ordered by D.L.H. has been delivered, and an order for 12 similar machines has been placed. The new series will be completed during next year.

SWISS TRAFFIC RETURNS

INTERNAL and international Swiss air services have carried, during the summer season of 1933, 32,548 passengers, 561,684 lb. of air mail and 978,864 lb. of freight. The corresponding figures for last year are given for comparison. Passengers 28,441, air mail 454,133 lb. and freight 930,571 lb.

A GERMAN AIRLINE IN BRAZIL

THE " Varig " Company, of Porto Alègre, Brazil, which is being operated by Germans with German machines, is fast developing its air services. During the first six months of this year the company carried about half as many passengers as the " Panair " Company, which also operates Brazilian services. " Varig " has surveyed nearly a thousand miles of airways throughout the country, of which 375 miles are receiving complete ground organisation. Nine aerodromes have already been established.

AIR-FRANCE AND NEW FARMAN

THE four-engined Farman " 220," fitted with a 600-h.p. Hispano engine, which was built for long-distance bombing, is continuing its tests at the Service Technique of Villacoublay-Paris. Messrs. Nogues and Balazuc, technical directors of Air-France, recently had flights in this machine.

PACIFIC AIRSHIP LINE

A REPORT from America states that a trans-Pacific airship line is to be inaugurated as soon as the necessary legislation has been passed by the Congress. California, Honolulu and the Philippines will be linked.

THE DELAY OF THE " POSTJAGER "

THE 596 lb. of mail which was being carried in the Pander " Postjager " when she was delayed in Italy with engine trouble has been taken from Brindisi to Cairo by an Imperial Airways machine. The mail was transferred to the regular K.L.M. Dutch Indian mail machine bound for Batavia. Thus the mail will reach its destination in time for Christmas.

" A WONDERFUL BIRD IS THE PELICAN "

THE Dutch were disappointed when the Pander " Postjager," which for weeks they had idolised, failed to break the record for the Amsterdam-Batavia trip owing to engine trouble in Italy. They were mortified, we suspect, when the Fokker F.XX, their " second string," also gave trouble with her engines on December 18 before starting on a journey over the same route. The " next best thing " was a Fokker F.XVIII, a type which is regularly used on the Holland-Indies route. The particular F.XVIII in question was the *Pelican*. We remember her visit soon after she was built ; she has been in service now for about two years. The mail in the F.XX was transferred to the *Pelican*, which left Schipol Aerodrome at 4.30 a.m. on Monday, December 18. On the first day only 1,000 miles were covered, but by noon on Tuesday the machine had landed at Cairo. About 2,350 miles were flown on the second day of the trip. On Wednesday at 5.45 p.m. (G.M.T.) the *Pelican* landed at Jodhpur after flying 2,000 miles. She stayed at Jodhpur for about $1\frac{3}{4}$ hours, reaching Calcutta at 5.20 a.m. (G.M.T.). At dawn on Thursday a landing was made at Rangoon, and by 4.20 p.m. (local time) the last thousand miles to Batavia had been covered. Thus the trip was completed in less than half the time taken by the machines operating the regular service. We congratulate Smirnoff and Soer on their powers of endurance. Scanty publicity has been given to their achievement ; it is not until one remembers that the F.XVIII, which has a speed of 152 m.p.h., took little more than half a day longer than the time in which the pilots of the " Postjager " (which has a top speed of about 223 m.p.h.) intended to make the flight, that the merit of the performance is fully realised. The American engines in the " Postjager " and F.XX gave trouble, but the well-tried " Wasps " in the *Pelican* behaved magnificently. The latest news to hand is that Smirnoff and Soer are flying the *Pelican* back to Amsterdam. They left Batavia on Boxing Day and hope to reach Holland before the New Year.

SWISSAIR EQUIPMENT

WE announced some time back that a representative of Swissair was in America to purchase new machines. We now gather that the purchase of a Douglas " Airliner " and a Lockheed " Electra " is being considered. These aircraft will complete the flying equipment of Swissair for 1934.

THE LATEST WIBAULT DEVELOPMENTS

Two fast three-engined monoplanes are to be constructed by Wibault-Penhoët. The first will be an improved version of the well-known type 282 T 12 machine as used by Air-France. It is to be known as the 283 T 12, and should have a cruising speed of about 170 m.p.h. The second design is a large commercial type, carrying 32 passengers and a crew of four. A top speed of 235 m.p.h. is expected when fitted with three " Gnome-Rhone K-14 " geared and supercharged engines of 845 h.p. each.

THE LEO 24-I FLYING BOAT

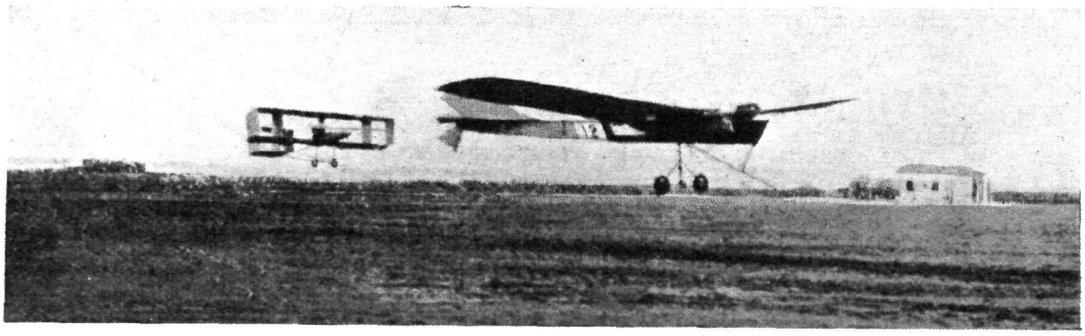
THE four-engined Liore et Olivier flying boat (" Gnome-Rhone K-7's ") recently made its first test flight when it flew from Marseilles to Algiers and back.

99.44 PER CENT. REGULARITY

IT is announced by the United Air Lines of America that in the six months of operation during the summer season its machines maintained a regularity of 99.44 per cent. on its commercial services. Over the Chicago-California route 785,000 miles were covered, and 1,293 passengers, 190,500 lbs. of freight and 2,205 lbs. of air mail were carried.

THE " WESTFALEN " EXPERIMENTS

THE catapult ship *Westfalen* is to return to Germany after concluding her tests to receive improvements. A second vessel of similar type is being fitted with catapult equipment. The Deutsche Lufthansa stressed the fact that a postal service across the South Atlantic, on which catapult ships are used, cannot be a final solution to the problem.



THE FIRST EGYPTIAN MEETING : Latham on his Antoinette overtakes Rougier on a Farman biplane at Heliopolis in 1910. Low flying was not barred. This photograph was first published in FLIGHT of February 26, 1910.

THE SECOND INTERNATIONAL EGYPTIAN AVIATION MEETING

By Our Representative specially sent out to Egypt to write the account of the Meeting

THE International Aviation Meeting held in Cairo from December 18 to December 24 was the second meeting of this kind to be held in Egypt. The first was held in the year 1910, from February 6 to February 13, and was described in the issues of FLIGHT for February 12 and 19 of that year. The pilots who took part included Rougier, Latham, Metrot, Le Blon, Balsan, Grade, Farman, and Curtis. It is interesting to note that at that meeting a little over 10,000 ft. won a height contest, the longest distance flown was about 54 miles, and the greatest average speed attained 47 m.p.h. Machines taking part included Voisin, Antoinette, Bleriot, Grade, Farman, and Curtis.

The meeting of this year was held under the Sporting Regulations of the Federation Aeronautique Internationale. The object of the meeting was to stimulate an interest in aviation and to emphasise the advantages of aeroplanes for travel and transport. There were three contests, the Circuit of the Oases, a Speed Race, and the Oases Trophy awarded to the competitor gaining the highest total of points in the other two contests.

Cairo, December 16, 1933.

Everyone connected with civil aviation in Egypt, and that includes a large number of modern Egyptians besides the officials of Misr Airwork, is looking to the Congress of the F.A.I. and the Flying Meeting which is being held next week, to place Egypt among the countries to which people will fly in increasing numbers. The modern Egyptian is keenly alive to the value of flying ; he is intensely proud of his country, and is well aware of the value both to himself and to his visitors of its climate and antiquities. It is only natural, therefore, that he should foster aviation, as nothing opens up a country more quickly than does the provision of flying facilities.

French Entries

Comp. No.	Reg. No.	and Pilot	Machine and Engine
1	F-AMLZ	A. Lamur	Caudron " Phalene " (Renault " Bengali ")
2	F-AMAU	A. Caizergues	,, ,, (Gipsy III)
4	F-AMIN	M. Bedel	,, ,, (Renault " Bengali ")
5	F-AMIO	A. Laumet	Caudron " Super " (Gipsy Major)
6	F-AMIR	L. Durafour	,, ,, (Renault " Bengali ")
7	F-AMAX	M. Alberge	,, ,, (Gipsy Major)
8	F-AMLQ	R. Bril	,, ,, (Renault " Bengali ")
9	F-AMOI	M. Finat	Farman 199 (Lorraine " Algol ")
10	F-AMMS	D. Robert	Caudron " Phalene " (Hispano 150)
11	F-AMKC	M. Averous	,, ,, (Renault " Bengali ")
12	F-AMSK	M. Fremont	,, ,, ,, ,,
14	G-ABJD	R. Mussard	D.H. " Puss Moth " (Gipsy III)
15	F-AMGM	M. Stiebel	Potez 43 (Gipsy Major)
16	F-AMMO	L. Challe	Caudron " Phalene " (Renault " Bengali ")
25	F-AMPQ	M. Lasue	Farman 193 (Farman 200)
26	F-ALHV	J. Puget	,, 234 (Salmson 7 AC)
27	F-ALMA	M. Lebeau	,, 353 (Gipsy III)

British Entries

3	G-ABYM	Flt.-Lt. P. Pope	Avro 626 (A.S. " Lynx ")
17	G-ACJW	P. Randolph	Percival " Gull " (Gipsy Major)
23	G-ACLI	S. Cliff	Miles " Hawk Special " (Gipsy III)
24	G-ABKZ	Sqd.Ldr.F.O.Soden	D.H. " Puss Moth " (Gipsy III)
29	G-ACKU	W. D. Macpherson	D.H. " Dragon " (2 Gipsy Major)

Yugoslavian Entries

30	YU-SAN	M. Stryevski	Spartan " Cruiser " (3 Gipsy Major)

Belgian Entry

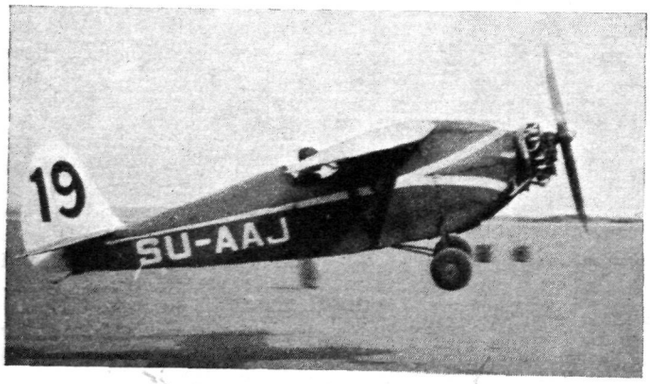
13	OO-ENC	G. Hansez	D.H. " Fox Moth " (Gipsy Major)

German Entry

18	D. 2728	K. Schwabe	Klemm (Siemens S.H. 14A)

Italian Entries

21	I-MORO	A. Novelli	Savoia Marchetti S. 80 (Colombo)
22	I-ACIE	E. Guglielmotti	Breda 39 (Colombo)



SITTING DOWN : The Comper " Swift," piloted by Mohamed Hasek, lands over an obstruction. (FLIGHT *Photo.*)

The sights of Egypt are widespread and separated by large stretches of inhospitable, uninteresting desert. Travelling over those stretches, even in specially ventilated Wagons-Lits and Pullman railway trains, can be a very dusty and tiring business. Flying, however, offers the traveller a method of reaching his goal which not only does away with the necessity of breathing in clouds of fine dust for long periods, but also shortens the time spent looking out of a window at miles of hot wavy-looking " nothing." It is therefore a type of country which should be passed over as rapidly as possible, and flying offers the pleasantest way of doing that. Incidentally, such work also brings to the notice of everyone the need that exists for aeroplanes with a far higher cruising speed than can be had to-day at a reasonable cost. All the competitors with whom we have spoken have expressed the wish that they could have covered the long stretches of desert, on their journey to Cairo, at a higher speed.

The present meeting, as has already been announced in

THE GERMAN REPRESENTATIVE : Herr Schwabe filling up the tanks of his Klemm. (FLIGHT *Photo.*)

FLIGHT, includes a touring competition over a route which leads to several oases where, until recently, civil aeroplanes had not landed. The landing grounds at these oases were laid out by the Egyptian Army Air Force under the command of Kaimakam Tait Bey, and under his direction a map was prepared by the Egyptian Survey Department for the use of the competitors. It was not until the Shell Company's "Puss Moth" flown by Mr. Barrington-Mason went round in connection with the provision of refuelling facilities, that they were used by a civil aeroplane.

At the time of writing—Sunday, December 17—competitors number 1 to 23 have arrived and been registered. News of the others is naturally very difficult to gather, but we understand that the weather experienced by those who are flying from Europe has been almost indescribably bad. This has, of course, penalised the English competitors more than any others. Of the 23 arrivals, 14 are Frenchmen, the majority of whom have come from Oran and Algeria; 3 are English, only 2 of whom have, however, got through from England, the third being a locally-owned machine; one is German; one is Belgian; two are Italian and two are Egyptian. There are many rumours of others who may get through in time, and everyone hopes that they will do so. The officials have all done their best to make the meeting not only an interesting one, but also truly international in character so that it will cause great disappointment if the weather prevents many of the European competitors from reaching Cairo in time. They have until Monday night to do so, therefore hopes run high among the countrymen of those who are only represented by a few machines, that the numbers will be increased by the actual day of the competition.

In order to facilitate the work of the judges, many of those who have already arrived have been subjected to inspection and preliminary tests. These consist of (1) a Wing-folding Re-erecting Test; (2) a Take-off and Landing Test; (3) a Safety Factor Test.

Special log-books have been issued to all competitors, in which all details relating to the competitions have to be entered by the officials, and these entries are the basis for awards. The following extracts from the official rules explain the procedure for these tests, and also the formula upon which marks are awarded for the Circuit of the Oases. Speed over the whole course and fuel consumption per passenger-mile are the factors of chief importance. Following them come range, sinking speed, ease of wing folding, and marks awards by judges for certain matters which are constant, as, for example, comfort, silence, layout of equipment, accessibility, etc.

Marks in this competition will be awarded according to the formula :—

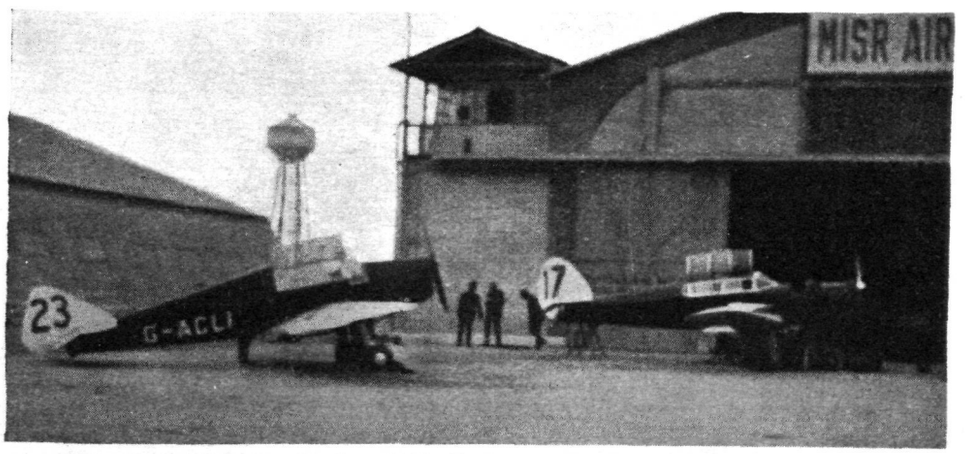
$$N = 100\left(12\frac{v}{V} + 12\frac{P}{p} + 8\frac{d}{D} + 6\frac{t}{12} + \frac{Q}{q} + \frac{C}{10}\right)$$

where N = Total number of points obtained by a competitor. V = Fastest speed of any competitor over the course. v = Actual speed of the competitor over the course. P = Lowest petrol consumption per passenger mile of any competitor. p = Actual petrol consumption per passenger mile of the competitor. D = Greatest range under condition of flight of any competitor. d = Actual range under condition of flight of the competitor. t = Time in minutes up to 12 minutes taken by the competitor in reaching the ground after cutting off one (or the sole) engine at a height of 2,000 ft. Q = Shortest time taken by any competitor in folding and re-erecting his aircraft. q = Actual time taken by the competitor in folding and erecting his aircraft. (N.B.—This test must be carried out by not more than two members of the crew of the competing aircraft.) C = The number of points awarded by the judges on matters that are constant. The following are the points which will be taken into consideration and the scale on which marks will be awarded :—(*a*) Provision for carriage of luggage, 20 ; (*b*) comfort (*e.g.*, silence, view, seating, etc.), 20 ; (*c*) method of starting engine, 20 ; (*d*) safety provisions for passengers and crew, 10 ; (*e*) ability to take off and land in a confined space (special test prior to touring flight), 30 ; (*f*) arrangements of controls and instruments, 10 ; (*g*) equipment for night flying, 10 ; (*h*) accessibility for refuelling, 10 ; (*i*) accessibility for routine maintenance of engine and aircraft, 20 ; (*j*) provision for picketing, 10. (Note.—Amphibians will be required to take off from the land and land on the water and *vice versa* during the take-off and landing test. A 10 per cent. increase to the marks actually obtained for cruising speed, petrol consumption and range will be awarded to amphibians passing this test.)

So much for the official side of the meeting in so far as rules and regulations are concerned. Owing to the fact that our air mail services are still regarded as luxuries by our Post Office, we shall be unable to deal with the Circuit of the Oases itself until next week, and shall therefore not describe the details of the route until we can report that competition in full.

This is the second International Egyptian Aviation Meeting, the first having been held 23 years ago. During the intervening time much has changed in Egypt, but until recently little was done to open up the country for the free passage of civil aircraft. Now those barriers have been removed, and this meeting will, the Aero Club of Egypt hopes, do a great deal towards opening up their country.

Every day the excitement at Almaza grows in intensity. The airlines which are being operated by Misr Airwork have already

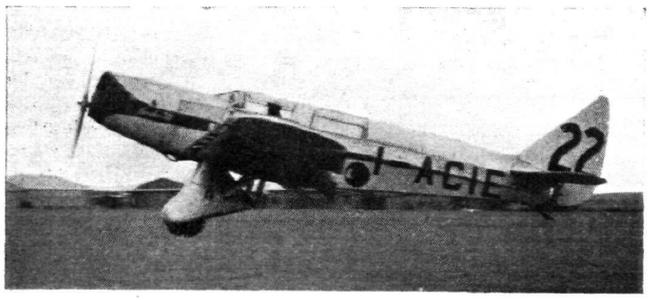


TWO BRITISH LOW-WING MONOPLANES : The "Hawk Special" on the left and the Percival "Gull" on the right. (FLIGHT *Photo.*)

A FRENCH ENTRY : M. Alberge's Caudron "Phalene" ("Gipsy Major") after its arrival at Almaza. (FLIGHT *Photo.*)

roused the people's interest in flying, and to-day (Sunday) the aerodrome presented quite a fashionable scene, despite the counter attraction of the racing at Heliopolis.

Opinions seem very divided about the Oases course. Some people think that it will cause considerable trouble to the competitors and that forced landings will be dangerous. This is, however, discounted by the fact that several machines of the Egyptian Army Air Force will be following the competitors, as "whippers-in." These are two Avro "Tens," flown by Bimbashis Stocks and Cottle, four Avro "626's" in charge of Bimbashi Webster, the other pilots being Messrs. Chalifa, Nagi and Whitlock, and one "Moth" flown by Hakki. [One of the Avro



SLOTS : Guglielmotti's Breda in the take-off and landing tests. (FLIGHT *Photo.*)

"Tens" crashed at Assiut on December 10, all on board being reported slightly injured.—ED.] The Egyptian Army Air Force has already done a great deal towards the competition, besides the actual mapping of the course. Last Friday they took some aircraft round with Taka Pasha as a passenger, visiting Assiut and Dakhla. It is to be hoped, therefore, that these machines will find anyone who is unfortunate enough to make a forced landing. Incidentally, the fact that a forced landing in the desert is to be avoided, is emphasised by the fact that multi-engined machines receive a great advantage in the Safety Factor Test. In that test the time taken to descend from 2,000 ft. is the basis of the marks received. Single-engined aeroplanes have to stop their airscrews completely, but multi-engined aeroplanes only have to stop the airscrew of one engine. There is therefore no reason why machines like the "Dragon" (two "Gipsy Majors") or the Spartan "Cruiser" (three "Gipsy III") should not gain full marks for this test.

At the same time, everyone appears to agree that machines can be difficult to find, and often, owing to the sand dunes, impossible to reach by aeroplane. In this part of the world the desert is by no means flat, and even the prepared landing grounds are said to be "not too funny." In many places it is impossible to find an area flat enough for anything except an Autogiro, as even where it is free of hills and sand dunes it is often corrugated badly. Another thing which may worry the competing pilots is the loose, wind-driven sand at the Oases. This is fine, and besides being soft for landing upon is also difficult to see, "worse than glassy water" is the description by one pilot who flew there recently. All of which rather goes to show that the trip round the Oases may not be a picnic for some of the less fortunate pilots, but it will certainly show the type of aeroplane which is most suited for travel in this country, and we hope that all our aircraft constructors will study the results carefully. We shall not be able include the full and complete results, even in our report next week, as these will not be published until they have been collected and worked out, a process which may take several days after the conclusion of the meeting.

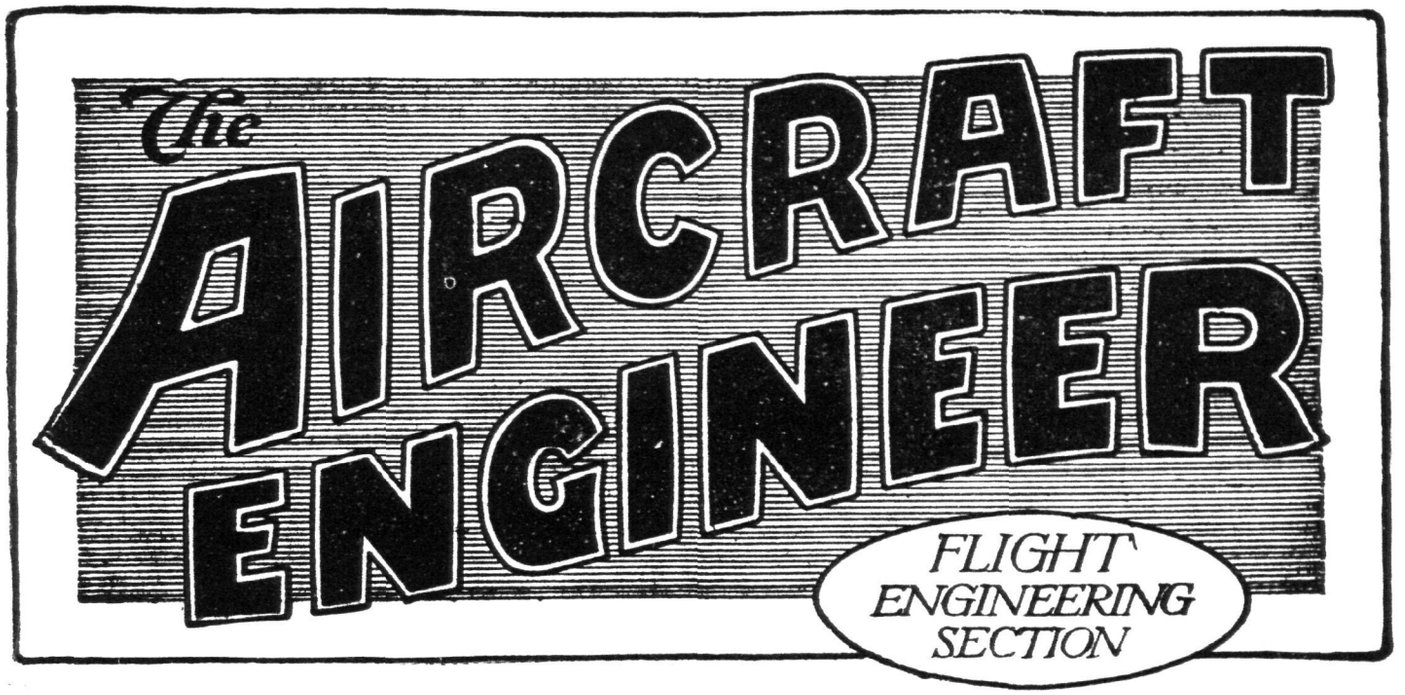
Seven more aeroplanes arrived to-day, Monday, up to 5 p.m. The Spartan "Cruiser" (3 "Gipsy III") from Yugoslavia and belonging to the Aeroput Company, was the last to arrive just before dark. It is possible that someone will come during the night, but from the information available this does not seem likely.

The whole of to-day has been taken up with the preliminary tests and inspections. The Take-off and Landing Tests, though perhaps the most spectacular part of the programme, certainly cause the most trouble, both to the officials, who have to sit out on a hot aerodrome all day, eating dust, and to the competitors. Many of the pilots had to fly off these tests during the previous day, and did so when there was very little wind. To-day there has been quite a strong breeze, and, naturally, the performance of machines of a similar type was much better. There does not seem to be any allowance for the wind in the regulations, but perhaps this is a point which will be taken into consideration in the final placing.

Slightly over 10 per cent. of the total marks are for the Safety Factor Test. This seems a fairly large amount in view of the fact that the test was devised to serve as a measure of the safety of the machine in the event of a forced landing. It is true that if the machine is a multi-engined one, which can maintain itself in the air with one of its engines out of action, then that machine will gain full marks for the test and is certainly shown to be one which will be safer than one which is dependent upon a single engine. As, however, it is the time to reach the ground which is the factor taken into consideration for marks, it matters not, in the case of a single-engined aeroplane, whether the glide is slow, though like the proverbial "brick," or fast and flat. The time taken to reach

(Continued on page 1312)

AN ANGLO-BELGIAN ALLIANCE : The de Havilland "Fox Moth" flown by the Belgian pilot, Hansez, in take-off test. (FLIGHT *Photo.*)



Edited by C. M. POULSEN

December 28, 1933

CONTENTS

NOTES ON THE DESIGN OF COMMERCIAL AIRCRAFT

By W. O. Manning, F.R.Ae.S.

Mr. Manning, as most of our readers will be aware, is one of the pioneers of British aircraft designers, his experience dating back to the "heroic" years of 1910-11 and extending up to comparatively recently. Mr. Manning is not nowadays a professional aeroplane designer, in the sense that he is not connected with any particular firm as designer. His views on the subject of design are, therefore, entirely unbiassed, which may account for the fact that they are usually very refreshing to those of us who are submerged in the subject every day.—Ed.

Taking first the question as it concerns commercial aircraft, there is no doubt that progress in these machines is in the direction of improving speed and comfort, but the importance of speed on the various aircraft routes depends necessarily on the nature of the traffic and on the speed of competing methods of transport. Take, for instance, the London-Paris route. The distance is about 260 miles, and the best train and boat time is about 7 hr., with an average of less than 40 miles an hour. This is rather slow, but the transference of passengers from train to boat and boat to train, combined with the slow steamship passage, necessarily takes time. The Imperial Airways time is 4 hr. from the London depôt to the Paris depôt, giving an average of about 63 miles an hour.

If the Channel tunnel was in existence, the train speed between the two capitals would probably be increased to an average of at least 55 miles an hour, reducing the time now taken between them to about $4\frac{3}{4}$ hr., or only three-quarters of an hour more than the time taken by the air route. If this happened there is no doubt Imperial Airways would require much faster aeroplanes if they wanted to keep their traffic.

The influence of the factor of the comparatively slow speed of the competitive route is reflected in the design of the Imperial Airways machines, for if an advantage of three hours in time taken is enough to attract the necessary traffic, why trouble to fly any faster? Especially as the slower machine has an advantage over the faster in the amount of pay load it can carry on each trip.

The conditions in the United States of America are quite different; here the air route has to compete with an excellent train service, so that in order to attract traffic the speeds of the machines used must be high. In fact, the latest types used there can cruise at about 170 miles an hour.

It is of great interest to contrast the types of aeroplanes used here and on the American services, especially as the conditions are so different, but in doing so it should be remembered that, while there are many large American operating companies, there is only one large English one, so that there is a larger demand for new types in America than there is here.

The bulk of the Imperial Airways traffic is still carried by the "Hannibal" class, which is characterised by its large pay load, moderate speed and four engines. This number of engines is considered important from the point of view of safety, and British passengers have been educated to believe that security resides in a much subdivided power plant. The older "Argosy" class had three engines only, and this number is considered here to be the minimum for a passenger air liner. Imperial Airways are one of the only large air operating companies which still use biplanes; though the most recent design used by them in Africa is a monoplane, the "Atalanta" type, they have reverted to the biplane in the new machines now being built by Short Bros.

I am personally of the opinion that the monoplane is the type of the immediate future. Not only does the monoplane offer the advantage of great cleanliness in design by eliminating the struts and bracing of the conventional biplane, but it also possesses the advantage of reduced upkeep cost, as there is so much less structure to be maintained in good order. It would be reasonable to suppose, therefore, that the future machines of Imperial Airways will resemble the "Atalanta" type, though the provision of four engines on a monoplane is always a difficulty. If they are arranged in tandem, as in the latest Fokker, there is a sacrifice of propeller efficiency, which means a loss of thrust which is especially serious when the aeroplane is taking off. Alternatively, the wing has to be cut up with a number of engine nacelles, which is bad from the aerodynamical standpoint.

The logical development to get over this trouble would be to put the engines inside the wings. This is not possible with the air-cooled radial type of engine, but would become easy with a water-cooled engine, especially if the latter was of the multi-cylinder horizontally opposed type. There are no suitable engines of this latter type in existence at present, though there is no engineering difficulty in building them. Even the normal V type of water-cooled engine would enable considerable improvement to be made in the performance of multi-engined monoplanes, and I expect to see it introduced in the machines of the future.

The American large passenger aeroplane seems to be crystallising into the two-engined monoplane with folding chassis, everything being done to reduce resistance and increase speed. As the Americans are the only people who are at present developing two-engined aircraft of this type, a consideration of the case for two engines becomes of interest. Generally speaking, a breakdown of a modern aero engine in flight is a remote contingency, but one which has to be guarded against. On the other hand, a breakdown of two is so remote as to be not worth considering. It therefore follows that a two-engined aeroplane should be safe from engine breakdown in flight, provided that it can fly well on its remaining engine.

But this means that a large excess of power has to be provided, as the machine must fly well on half-power, whereas in the case of three- or four-engined aircraft only 33 per cent. or 25 per cent. of the total power is deleted in the case of an engine failure. The recent American two-engined aeroplanes possess large excess power in any case, and must possess it in order to attain their high speeds; and the possibility of flight on one engine is increased by the almost universal use of variable pitch propellers which enable the propeller of the engine in use to be set to a lesser pitch, so increasing thrust.

The recent Douglas air liner may be considered as a good example of the most recent American design, and the claims made for it show what can be done with an aeroplane of this type. The machine itself is a low-wing cantilever monoplane with retractable chassis, powered with two Curtiss air-cooled radial engines giving a total horse-power of about 1,400. The cabin holds 14 passengers and the aeroplane has a top speed of about 210 miles an hour and cruises at about 180 miles an hour. In flight the machine consists simply of the tail unit, the fuselage, the wing and the two engine nacelles, and these parts are the minimum possible with air-cooled engines. It is claimed that this aeroplane can actually take off the ground with one engine stopped with full load, and that, in this condition, it has a ceiling of over 8,000 ft. A performance such as this is remarkable and would hardly be possible without variable-pitch propellers.

It is also doubtful whether it would be possible with more than two engines. If it is proposed to fit three, there is only one place where the third can be put, that is, on the nose of the fuselage, where the vibration and noise interferes with the comfort of the passengers and where the presence of the large fuselage interferes with the propeller efficiency. If four are to be fitted they have either to be as the "Atalanta," in a row, or tandem, with accompanying disadvantages. Hence, the arrangement adopted is the best. But the machine still possesses prominent engine nacelles which are necessitated by the air-cooled engines, and I expect to see, in future, that water-cooled engines will be fitted in the wings of aircraft of this type; were this done, the speed would probably be increased some ten or fifteen miles an hour. Further refinements are also possible in the shape of the fuselage and in the way the wings are faired into the body, and it would seem that top speeds of the order of 250 miles an hour should be possible with future machines without increasing power, especially if wing radiators are used so as to abolish radiator resistance.

Recent developments in France may be judged from the recent Dewoitine monoplane, which may be considered as intermediate in type between British practice and American. This machine has three Hispano-Suiza 9V. air-cooled radial engines developing together 1,950 h.p., two being mounted on wing nacelles and the third on the nose of the fuselage. It has a top speed with full load of 187 miles an hour and cruises at 156. The chassis is not retractable, but the wheels and shock absorbing gear are covered by large fairings. The machine does not show the extreme cleanness of design of the American types, and neither in England nor America would a nose engine be tolerated on a large passenger aeroplane for the reasons given previously.

In almost every particular the design and performance is a compromise between British and American practice, and it is stated that the machine has a ceiling of about 10,000 ft. with one engine cut out. Its performance in service in the Far East will be watched with interest.

A recent development in France is the reported placing of an order for some single-engined aeroplanes with a top speed of 250 m.p.h. for postal services. If the report is correct, these will be the fastest commercial aircraft in the world.

Dutch practice, as exemplified by the recent Fokker FXX, seems to be tending in a direction of its own. This machine is a three-engined high-wing monoplane carrying 12 passengers in addition to the crew, and propelled by three Wright "Cyclone" engines of a total power of 1,920 h.p. The top speed is 186 m.p.h. and the cruising speed 154 m.p.h. The Dutch designer still adheres to his well-tried plan of a high-wing monoplane, but places his wing engine in well streamlined nacelles placed a short distance below each plane. This arrangement necessitates the provision of a number of struts for supporting purposes between the wing and the nacelle, with the accompanying resistance, and the nearness of the nacelle to the plane suggests interference. But the adoption of a retractable chassis retracting into the engine nacelles is probably the factor which governed this part of the design, for in the normal layout of a large high-wing monoplane the wing is too far away to be a convenient place to put the chassis when the latter is not in use. According to British ideas, the nose engine is not a desirable feature, but it is difficult to discover what better place the designer can find for his third engine if, as is probably the case here, the customer insisted on his fitting one. The aeroplane is an excellent example of a modern large high-speed passenger aeroplane, and is believed to be behaving particularly well on service.

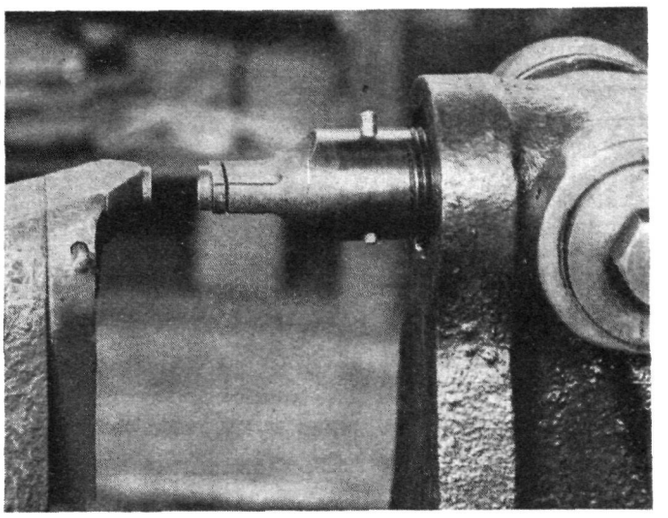
German practice is interesting from the use of water-cooled engines in commercial aircraft, and the appearance of such machines as the G.38 Junkers suggests at once that there should be considerably less interference between these engines and the wing than there is in the case of an aeroplane like the Douglas. I expect to see water-cooled engines come into use extensively in the future in the faster commercial aircraft, and it is interesting to note that they seem always to have been preferred by the Junkers firm. It is not easy to see, at present, the direction in which the actual commercial aircraft design is progressing in Germany, as it seems that the German Government is in favour of the construction of very large aircraft, and that the encouragement they are able to give to such machines by means of a subsidy may mean that the operating company is encouraged to use larger aircraft than they would otherwise consider desirable. It may be, therefore, that such machines as the G.38 were not designed and constructed on purely commercial considerations.

The G.38 has a top speed of 141.5 m.p.h., cruises at 116 and carries 26 passengers on a total weight of 52,900 lb., the total horse-power being 3,200 max. The "Hannibal" carries 38 passengers on a total weight of 29,500 lb., so that there seems some surplus aeroplane in the German design. But if, as is probable, commercial monoplanes increase in size, the general type of design typified by the G.38 is the direction in which advance may be expected.

DE BERGUE PATENT COUNTERSUNK RIVETING PROCESS

WHEN metal aircraft construction was demanded by the British Air Ministry, the aircraft constructor was faced by many new problems. The one which obtruded itself most forcefully at first was the forming of metal strip into corrugated sections. This was particularly the case with steel, which had an unfortunate habit known as "spring back," allowance for which had to be made in designing the rollers or dies used in forming the corrugations. Duralumin has less spring back, and thus the difficulties with this material were not quite so great. By now all the aircraft firms have found ways and means of overcoming this and other difficulties, such as keeping the strip from twisting when the corrugations have been formed.

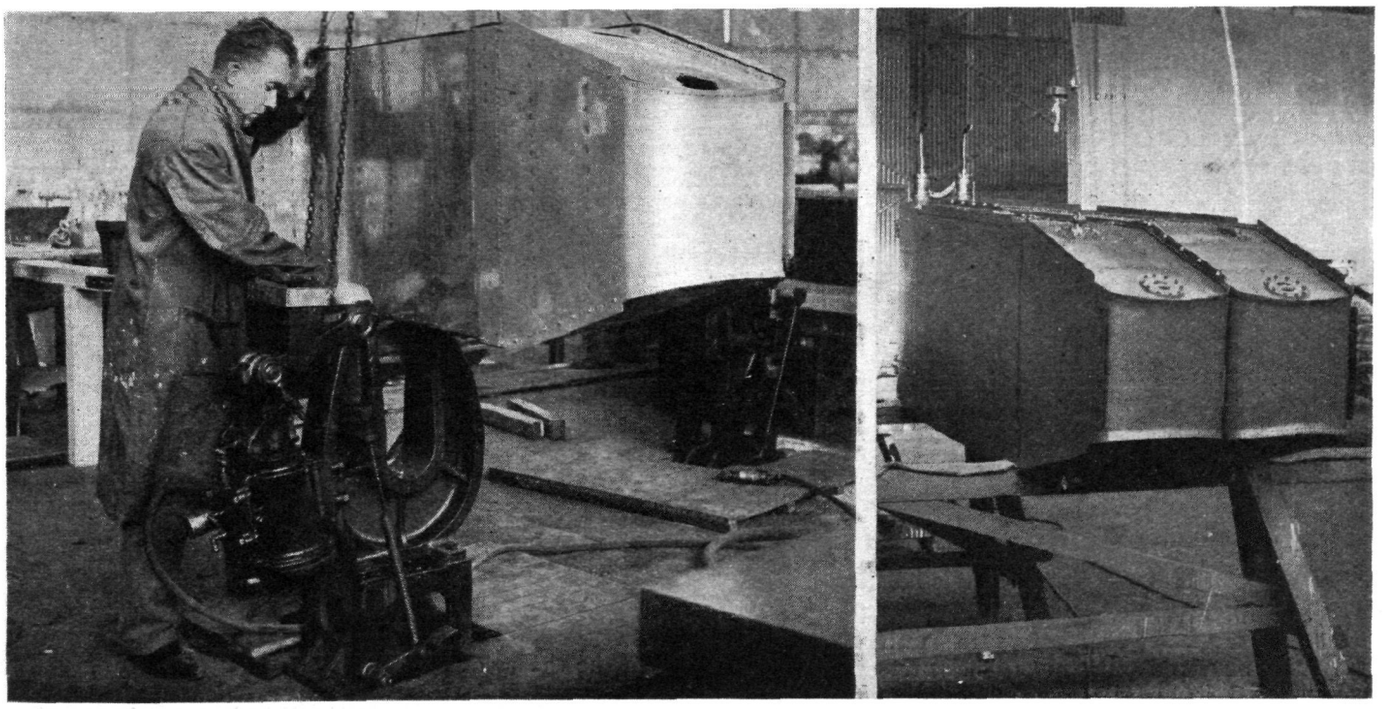
Riveting was another of the problems introduced with metal construction. The thin metal sheets and strips that had to be joined together called for very close spacing of the rivets if pulling and working loose of the rivets was to be avoided. Under most of the stresses in aircraft structures the rivets work in shear. That is to say, the two plates or strips joined together tend to shear off the rivet shanks, and if that does not happen, the rivet hole may become enlarged and trouble arise in this way. In structures such as wing spars, etc., a very small degree of creep may be tolerated, but if the structure be a fuel tank, for example, any small movement will cause a leak. A most ingenious system of riveting has been introduced recently which promises to simplify tank construction very materially, and may have many other applications besides. For the moment, however, we will confine ourselves to the question of petrol-tank construction. The new system is the invention of De Bergue's Patents, Ltd., of Strangeways Iron Works, Manchester, and is known as the De Bergue Patent Countersunk Riveting Process.



THE RAM: Pneumatically operated, this exerts a pressure of about 13 tons. There is a micrometer adjustment for sheet gauge. (FLIGHT *Photo.*)

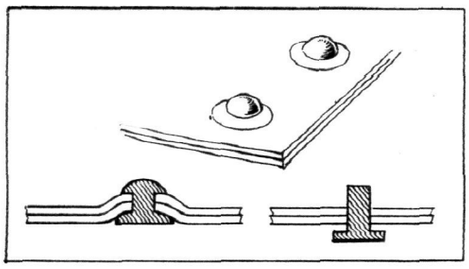
Handley Page, Ltd., represent De Bergue riveting in most foreign countries, and readers of FLIGHT abroad who wish to study the process are requested to communicate with this firm.

Fundamentally, the De Bergue process consists in countersinking the rivet head into the metal sheets or strips which are being joined. This cupping or countersinking is done simultaneosuly with the forming of the rivet head, and as both the sheets are cupped it will be seen that the rivet can only be subjected to tensile loads, all or practically all the shear on the rivet shank being avoided. One result of this is that the pitch of the rivets can be larger than with ordinary rivets, which should result in cheaper manufacture, although the



DE BERGUE COUNTERSUNK RIVETING: On the left, a large tank in the machine. The operator's treadle can be seen on the side. Right, a double tank of the H.P. "Heyford." (FLIGHT *Photos.*)

rivets themselves are comparatively expensive. This is not due to any technical difficulty in the manufacture of the rivets, but arises from the fact that the De Bergue Company has chosen this way of collecting royalties on the riveting process. The cost, they state, corresponds to a royalty of approximately 4d. per gallon of tank capacity. In view of the fact that one man can operate the pneumatic riveter, no holding up being required, this does not appear to be an excessive charge. The process, depending as it does on "squeeze riveting," demands pneumatic riveting machines capable of a pressure of several tons, and these naturally cost a good deal of money, so that the De Bergue process does not lend itself to cheap riveting in small quantities. As soon, however, as there is production work to be done, the process should be cheaper than normal riveting.



Diagrams of De Bergue riveting

By the courtesy of Handley Page, Ltd., we saw some De Bergue machines at work in the Cricklewood works, and secured a few photographs. The riveting machines used there are of the De Bergue No. 111 type, which weigh some 8 cwt. In this model the gap of the frame is vertical, with the ram placed horizontally. The riveting ram has a vernier adjustment for the gauge of sheet being riveted, and this governs also the degree of pressure which the finished rivet head exerts on the sheet. The rivet is inserted in the drilled hole, with its flat head against the, at that stage, flat surface of one of the sheets. The free end of the rivet shank passes into a recess in the opposite member (which may be regarded as the "dolly"), which is also shaped to receive the cupped portion surrounding the rivet. Finally, the ram presses right home, and in so doing, forms, by plain squeezing, the rounded head of the rivet. The speed of operation will obviously vary with the nature of the work to be done, tanks of complicated shape being slower to rivet than straight runs, but as an average figure the company quote some 150 per hour, less on some jobs and more (up to 200 per hour) on straight runs.

Handley Page, Ltd., fitted petrol tanks made by De Bergue riveting into the *Hannibal* and *Heracles*, and these have now done many hundred hours' flying without any trouble. The success achieved with the first tanks led to the general adoption of the system for all petrol tanks, and those fitted in the new "Heyfords" are all manufactured on the De Bergue principle. The system can also be applied to such items as large panels, wheel fairings, etc., and the fact that the flat rivet heads are sunk in flush with the surrounding sheet results in a very neat external appearance.

For petrol-tank construction a material known as Petroquoil Jointing is inserted between the two sheets to be lap-jointed. The tanks themselves are made of Alclad, while the rivets are of Duralumin. The first tank of a new type is subjected to a pressure of about 6 lb./sq. in., and subsequent tanks have to pass tests at 1.5 lb./sq. in. This refers to main tanks. For gravity tanks and oil tanks the pressure ("subsequent") is 1.75 lb./sq. in. On vibration tests a tank was filled with paraffin and subjected to $10\frac{1}{2}$ million vibrations, after which it was tested at 3 lb./sq. in., which it withstood satisfactorily, so that it would appear that the De Bergue system of riveting is proof against vibration troubles.

To give an idea of tank weights when De Bergue riveting is used, the following tank weights from the Handley Page "Heyford" may be of interest. Main petrol tank, 103 gallons, 68 lb.; oil tank, 10 gallons, 12.5 lb.; gravity tank, 12 gallons, 11.5 lb.

THE DESIGN OF AEROFOILS AND THE PREDICTION OF CHARACTERISTICS

By W. R. ANDREWS, A.F.R.Ae.S.

(*Continued from page* 83)

The application of this interesting correction to the calculated moment of a few mathematical centrelines will illustrate how it is applied and provide data for design and analysis.

Table X gives a few curves suitable for use as centrelines, together with their calculated and empirically-corrected moments.

It will be noticed that 1 and 2 are of the same form, but 2 has been included as it is the special case where $a = 1.0$ and the trailing-edge slope is zero, *i.e.*, the centreline is tangential to the chord at the trailing edge. For values of "a" less than 1.0 the section has a reflexed trailing edge which gives zero moment at no-lift when $a = 0.8675$.

If an aerofoil of this series is required having the point of maximum camber at some particular point x_1 the value of "a" to satisfy is given by

$$a = \frac{x_1(2 - 3x_1)}{1 - 2x_1} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

This relationship is plotted in Fig. 13. As "a" increases towards infinity, the shape of the centreline tends towards No. 3, which is the limiting case. Fig. 14 gives the value of h in terms of camber for different values of x_1.

There is too small an amount of data to generalise on aerofoils of this shape of centreline, but as will be shown later the maximum lift is rather disappointing, being no greater than that of a symmetrical section of the same thickness.

The form of centreline which seems to the writer to be of the greatest interest is No. 6, of which Nos. 4 and 5 are particular cases. With this form of centreline the point of maximum camber can be arranged to come at any point along the span (x_1) by a suitable choice of "n."

It will be shown in the section dealing with maximum lift that this value of x_1 is important where the maximum possible lift at fixed moment coefficient is to be obtained. The value of the leading-edge slope is $+nh$ and the trailing-edge slope $-h$ for all values of n.

For values of "n" greater than about 2, the rear portion of the wing is perhaps flatter than is common practice, but this is not anticipated to be a disadvantage, either to lift or drag, until the nose slope becomes absurd at high values of n.

R.A.F.28 has centreline of this family with $n = 2$.

Fig. 16 gives the variation of Km_0 in terms of values of h for different values of n. This curve is a maximum at $n = 2.0$, and is sensibly constant at 0.39 for values of n between 2 and 3, which represents the part it is anticipated would be most used.

We can now pass on to considerations of the angle of no-lift.

In the theory of R. & M. 910 the no-lift angle is shown to be dependent upon $F_1 = \int_0^1 y_0 f_1(x)dx$ only, but an analysis of the series of tests under review suggest that this is not quite borne out in practice.

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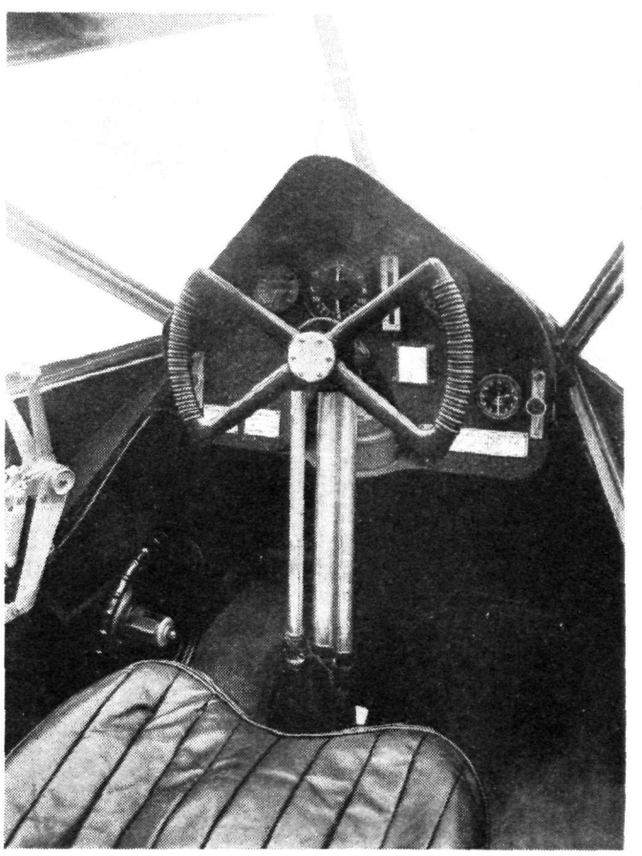

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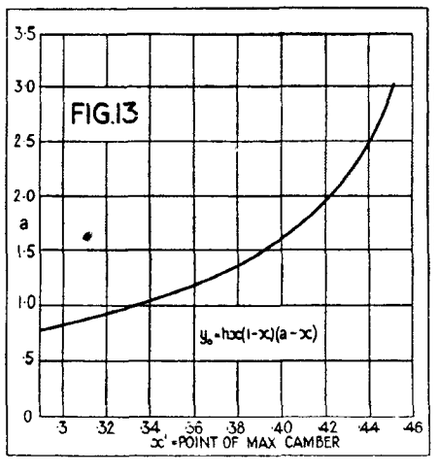
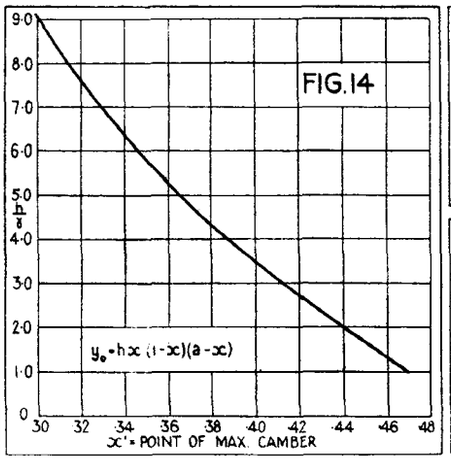
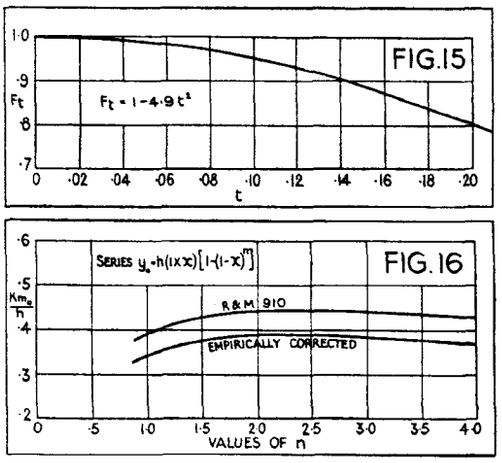
TABLE X

Column	1	2	3	4	5	6
No.	Ordinates of C.L. $y_0=$	Slope of C.L. at any point	L.E. Slope ϕ	T.E. Slope ψ	Km_0 calculated by method of R. & M. 910	Km_0 (empirically corrected)
1	$h\,x\,(1-x)\,(a-x)$	$h\,[a-2\,(1+a)x+3\,x^2]$	ah	$h\,(1-a)$	$\frac{\pi}{64}\,h\,(7-8\,a)$	$0{\cdot}3436\,h\,(1-4{\cdot}9t^2)\,x\,[0{\cdot}8675-a]$
2	$h\,x(1-x)^2$	$h\,(1-4x+3x^2)$	h	o	$\frac{\pi}{64}\,h$	$-0{\cdot}0455\,h\,(1-4{\cdot}9t^2)$
3	$h\,x\,(1-x)$	$h\,(1-2x)$	h	$-h$	$-\frac{\pi}{8}\,h$	$-0{\cdot}3436\,h\,(1-4{\cdot}9t^2)$
4	$h\,(1-x)\,[1-(1-x)^3]$	$h\,(3-12x+12x^2-4x^3)$	$3h$	$-h$	$\frac{9\pi}{64}\,h$	$-0{\cdot}3855\,h(1-4{\cdot}9t^2)$
5	$h(1-x)\,[1-(1-x)^4]$	$h\,(4-20x+30x^2-20x^3+5x^4)$	$4h$	$-h$	$-\frac{70\pi\,h}{512}$	$-0{\cdot}370\,h\,(1-4{\cdot}9t^2)$
6	$h\,(1-x)\,[1-(1-x)^n]$		nh	$-h$		







Aerofoil Centreline Shapes

Taking first the series having the maximum rise of centreline at half the chord, the value of $F_2 = \int_0^1 y_0 f_2(x)dx$ for this series is zero, since the centreline is symmetrical about 0.5 of the chord. Therefore, one would expect that the no-lift angle and the moment at no-lift will be dependent upon one another as suggested by theory.

The following table gives the result of such an analysis.

TABLE XI

Section	$-Km_0$	$\frac{-57{\cdot}3\times4Km_0}{\pi}$	$-a_0$ observed	$-$Difference degrees
4506	0·0535	3·90	4·32	0·42
4509	0·0535	3·90	4·13	0·23
4512	0·0505	3·68	4·03	0·35
4515	0·0485	3·54	4·07	0·53
4518	0·047	3·43	3·85	0·42
4521	0·041	2·99	3·40	0·41
6506	—	—	6·35	—
6509	0·079	5·75	6·35	0·6
6512	0·076	5·54	6·27	0·73
6515	0·074	5·39	5·91	0·52
6518	0·069	5·03	5·70	0·67
6521	0·064	4·67	5·23	0·56

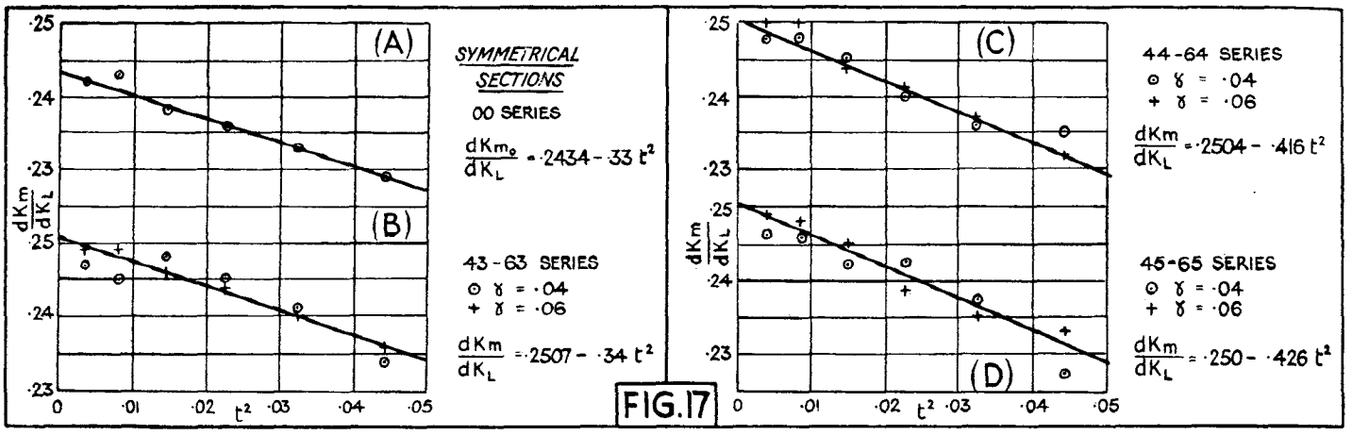
It will be seen from this that the mean difference in degrees is approximately 10 × camber ratio. Where the value of F_2 is not zero this relationship does not hold.

To get an agreement an amount corresponding to $\frac{F_2}{1-4.9\ t^2}$ (see Fig. 15) must first be added to Km_0. This same function of thickness appears in the empirical correction for Km_0. Its physical significance in that connection was not clear, but its re-appearance here is even less so.

The following table shows the final variation when

TABLE XII

Section	$-Km_0$	$\frac{-57{\cdot}3}{\pi/4}\left[Km_0-\frac{F_2}{Ft}\right]=-a_1$	$-a_0$ observed	$-$Difference $=-(a_0-a_1)$
4306	0·0375	2·74+0·58=3·32°	3·79°	0·47°
09	0·0375	2·74+0·59=3·35°	3·54°	0·19°
12	0·036	2·63+0·61=3·24°	3·60°	0·36°
15	0·034	2·48+0·64=3·12°	3·58°	0·46°
18	0·0325	2·37+0·68=3·05°	3·44°	0·39°
21	0·0285	2·08+0·73=2·81°	3·55°	0·74°
6306	—		4·82°	
09	0·0555	4·05+0·89=4·94°	5·35°	0·41°
12	0·0545	3·98+0·92=4·90°	5·35°	0·45°
15	0·0520	3·80+0·96=4·76°	5·30°	0·54°
18	0·0485	3·54+1·01=4·55°	5·18°	0·63°
21	0·0455	3·32+1·09=4·41°	5·20°	0·59°
4406	—		—	
09	0·042	3·14+0·30=3·44°	3·6°	0·12°
12	0·0435	3·17+0·31=3·48°	3·8°	0·32°
15	0·0415	3·03+0·33=3·36°	3·8°	0·44°
18	0·039	2·85+0·34=3·19°	3·7°	0·51°
21	0·036	2·63+0·37=3·00°	3·5°	0·5°
6406	—		—	—
09	0·0665	4·76+0·44=5·20°	5·25°	0·75°
12	0·0645	4·71+0·46=5·17°	5·75°	0·58°
15	0·0625	4·56+0·48=5·04°	5·75°	0·71°
18	0·0595	4·35+0·51=4·86°	5·75°	0·89°
21	0·0555	4·05+0·55=4·60°	5·3°	0·70°



Slope of Moment Curves

this empirical correction is applied to the remaining series of aerofoils.

Considering that $(\alpha_0 - \alpha_1)$ is obtained as differences between relatively large quantities, the results show remarkable consistency.

The majority of the cases show definite increases in $(\alpha_0 - \alpha_1)$ with camber, and to the degree of accuracy of the tests we may write

$$\alpha_0 = + \frac{57 \cdot 3}{\pi/4} \left[Km_0 - \frac{F_2}{F_t} \right] - 10\gamma \quad \ldots\ldots\ldots\ldots \quad (11)$$

where $F_2 = \int_0^1 y_0 f_2(x)\, dx$

$F_t = 1 - 4 \cdot 9\, t^2$

γ = Maximum camber ratio.

This relationship shows that to obtain an aerodynamically untwisted wing of tapering thickness but constant centreline proportions, the incidence along the wing must be varied as $+ \frac{57 \cdot 3}{\pi/4} \frac{F_2}{F_t} + 10\gamma$. The angle given is that of the datum line of the section with respect to some arbitrary plane.

To the limits of experimental error it now seems possible to forecast the no-lift angle of any section of the series.

The check is given (as for the moment coefficient) on sections N.60 and N.60.R. Taking first N.60, the value of $F_2 = 0.007$.

$$\therefore \alpha_0 = + \frac{57 \cdot 3}{\pi/4} \left(- 0 \cdot 0396 - \frac{0 \cdot 007}{F_t} \right) - 10 \times 0 \cdot 041$$

$$= \frac{57 \cdot 3}{0 \cdot 7854} \left(- 0 \cdot 0396 + \frac{0 \cdot 007}{0 \cdot 923} \right) - 0 \cdot 41$$

$\therefore$ Estimated $\alpha_0 = \underline{-4 \cdot 0^\circ}$ to N.A.C.A. datum

Actually $\alpha_0 = -5 \cdot 43$ to flat under surface.

$= -5 \cdot 43 + 57 \cdot 3 \times 0 \cdot 029$

$= -3 \cdot 77^\circ$ to N.A.C.A. datum.

Taking now N.60.R. where $F_2 = 0 \cdot 0141$,

$$\therefore \alpha_0 = \frac{57 \cdot 3}{0 \cdot 7854} \left(- 0 \cdot 0003 - \frac{0 \cdot 0141}{0 \cdot 923} \right) - 10 \times 0 \cdot 032$$

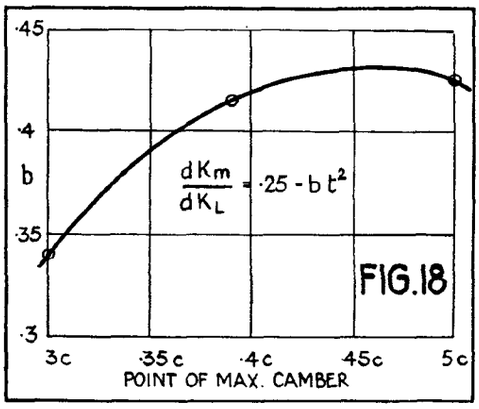
$= \underline{-1 \cdot 48^\circ}$ to N.A.C.A. datum.

Actual $\alpha_0 = -1 \cdot 48^\circ + 0 \cdot 001 \times 57 \cdot 3$

$= -1 \cdot 42^\circ$ to N.A.C.A. datum.

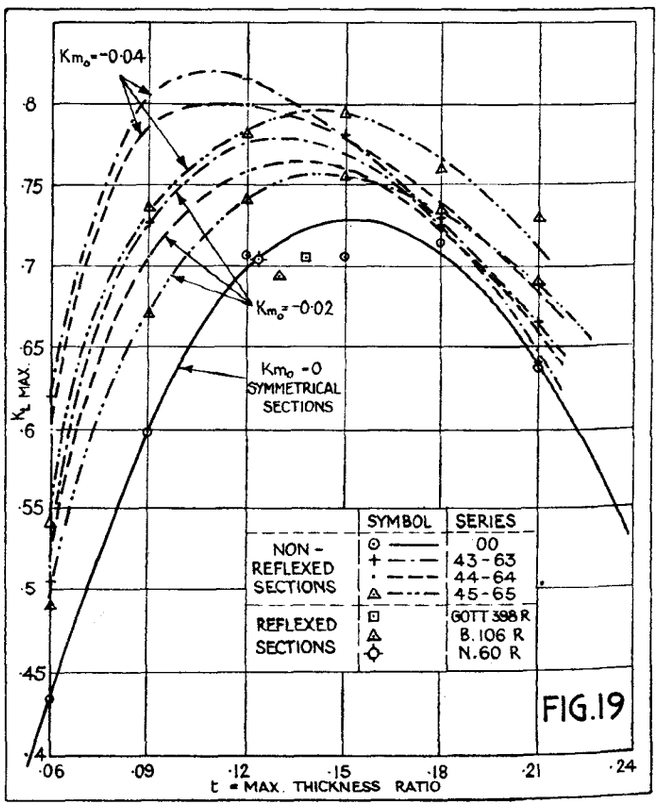
This agreement is within the accuracy to be expected, and shows that the empirical correction may be applied with confidence to practical sections.

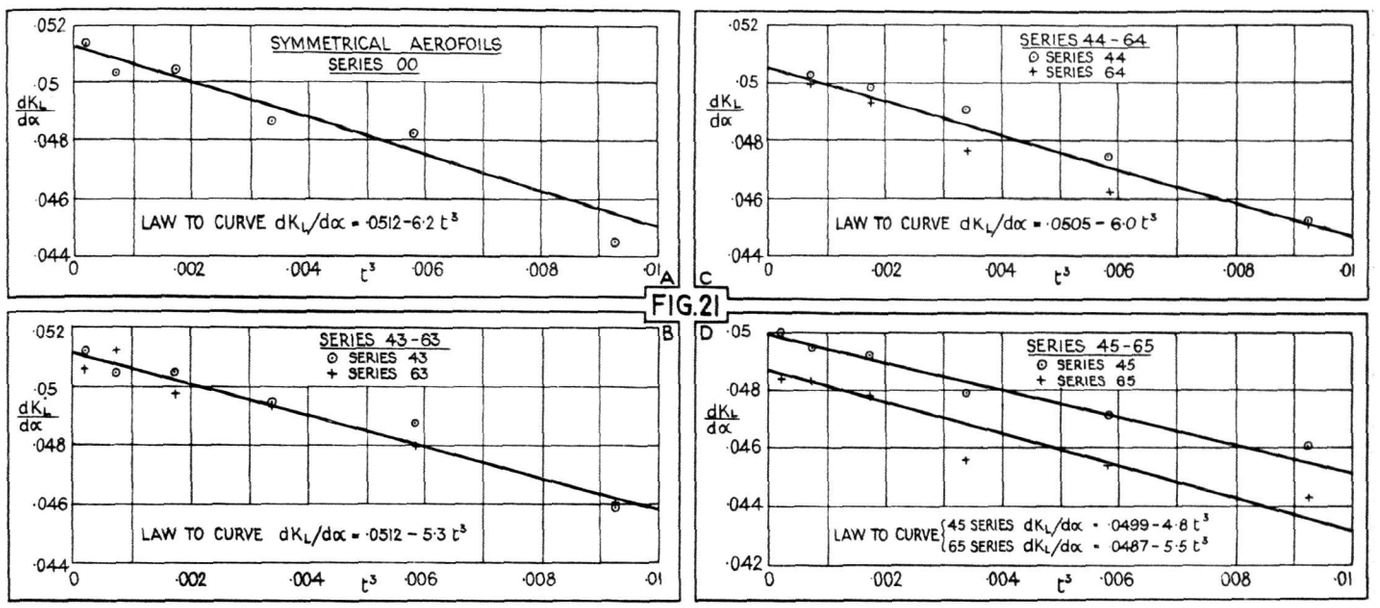
We will now consider the slope of the moment curve with lift. The theoretical value of 0.25 is not realised for any of the sections, but the extrapolated value for $t = o$ is approximately 0.25 where there is any camber of the centreline. For the symmetrical sections the value for $t = o$ is only 0.243 (see Fig. 17).



Slope of Moment Curves for Cambered Sections

The fall off with thickness is a function of t^2, the tests falling into two groups. The first group is the symmetrical sections and those with the maximum camber at 0.3 c. The rate of fall off of $\frac{dKm}{dK_L}$ for this group is approximately $\frac{1}{3}\, t^2$.





The second group comprises sections with maximum camber at 0.4 and 0.5 of the chord has a fall off of $0.42\ t^2$.

Taking the cambered sections, it would seem that the fall off in slope of the moment curve could be represented by Fig. 18. How reliable this curve is can only be found by comparison with future test results. The variation may be partly due to the choice of centreline shape, and any other shape having the maximum camber at the same point would not necessarily give the same fall off in slope as shown on the graph.

In the interim it is probable that a variation of the form

$$\frac{d\,Km}{d\,K_L} = 0{\cdot}25 - 0{\cdot}4\,t^2 \qquad (12)$$

will give results sufficiently close for practical purposes.

After all, the change in the estimated C.P. position due to neglecting the effect of thickness, is not likely to be serious.

There is no evidence to show at what camber the extrapolated value of dKm/dK_L for $t = o$ departs from 0.25 for the present cambered sections and tends towards that of 0.243 for the symmetrical sections.

The question of maximum lift has been dealt with in Ref. 1, which covered only the 43, 63 and 45, 65 series. A new set of curves has been made to show the variations covering the 44 and 64 series as well. The results are given in Fig. 19 for values of Km_0 of 0, −0.02 and −0.04.

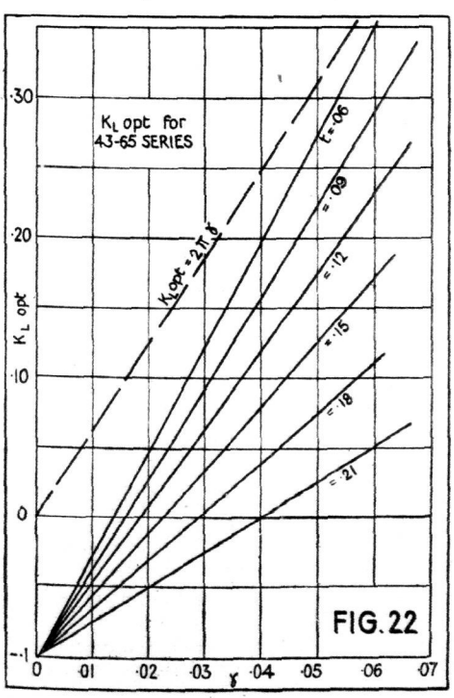
It appears safe to draw the following general conclusion from these results.

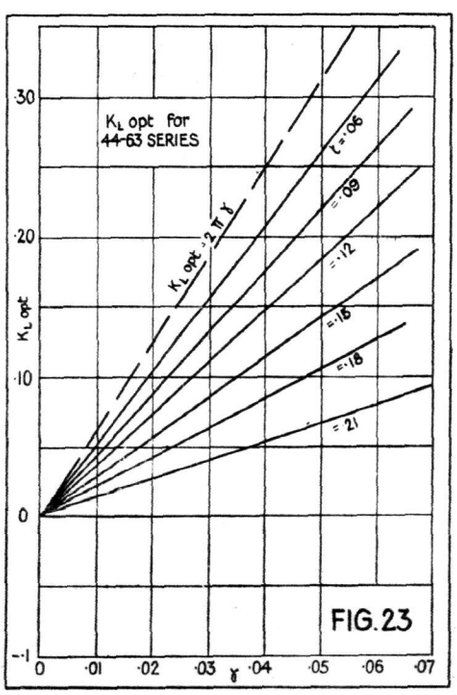
(1) To obtain the highest maximum lift, the point of maximum camber must move forward as the section is thinned and conversely moved backward as thicker sections are used.

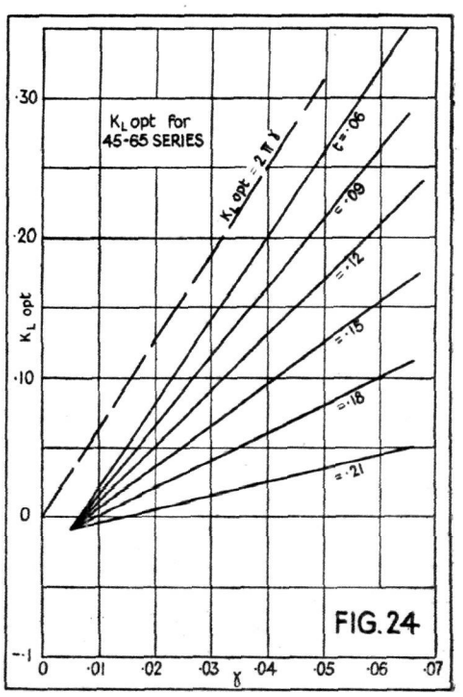
(2) There is a definite increase in maximum lift as the no-lift moment increases at all positions of the maximum rise of centreline and constant thickness.

For example, by moving the point of maximum camber from 0.3 to 0.5 of the chord at 19 per cent. thickness the same maximum lift is obtained with a no-lift moment of −0.02 as was previously obtained with $Km_0 = -0.04$.

If it is safe to extrapolate these results, it would seem that for sections in the region of 20 per cent. the point of maximum rise could be moved further back than 0.5 of the chord to obtain maximum lift possible for the particular thickness ratio. This important conclusion,







if substantiated, should greatly affect the design of wings tapering in thickness ratio along the span.

The $K_{L_{max}}$ for the reflexed sections on Fig. 19 shows that there is no gain in $K_{L_{max}}$ over that of the symmetrical section.

The sections given are in the region where the symmetrical sections showed instability at the stall. There is no suggestion of this instability with the reflexed sections.

So much for maximum lift, and now the slope of the lift curve will be investigated. Fig. 21 shows the dependence of dK_L/dx upon the cube of thickness ratio t. The laws to the curves drawn are given on the graph, and an average value covering the whole series is

$$\frac{dK_L}{dx} = 0{\cdot}0506 - 5{\cdot}65\,t^3 \quad \ldots\ldots\ldots\ldots\ldots (13)$$

The variation between the slopes for the different series does not appear to be systematic, so that the above generalisation is all that can be done.

The next item is the point of minimum profile drag.

The value of K_L at the point of minimum profile drag is designated at K_L opt.

In Ref. 2 curves for the 43—63 and the 45—65 series were given; these are reproduced here, together with that for the 44—64 series, but based on the N.A.C.A. definition of camber—Figs. 22, 23 and 24.

It is noticed that for the latter the curves drawn all pass through the zero and the law to the curves is

$$K_L \text{ opt} = (6{\cdot}6 - 25\,t)\,\gamma \quad \ldots\ldots\ldots\ldots\ldots (14)$$

This indicates that the value of K_L opt for a section of no thickness is $6{\cdot}6\ \gamma$ as compared with $2\pi\gamma$ given by the theory of thin aerofoils.

Expressing K_L opt as

$$K_L \text{ opt} = (\gamma + K)(A - B\,t) - D \quad \ldots\ldots\ldots\ldots\ldots (15)$$

as in Ref. 2, then K, A, B and D have the values given by the following table.

TABLE 13

Constant	Maximum Camber at :—		
	0·3 Chord	0·4 Chord	0·5 Chord
K	− 0·001	0	− 0·05
A	9·7	6·6	8·0
B	33·9	25	33·3
D	+ 0·1	0	+ 0·01

The choice of the constant is left to the individual until more information is available.

The final estimation of profile drag is then made as shown in the previous article (Ref. 2).

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

WIND TUNNEL TESTS OF AEROFOILS R.A.F. 38 AND 48. By K. W. Clark, B.Sc., D.I.C., and W. E. Wood, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1543. (6 pages and 6 diagrams.) May 27, 1933. Price 6d. net.

The lift, drag and pitching moments have been measured on 8 in. × 48 in. monoplane aerofoils from no lift incidence up to 40° in the No. 2 7-ft. tunnel at the R.A.E. The speed of test was 80 ft./sec. up to the stall and 50 ft./sec. beyond.

The main characteristics at R = 0·335 × 10° are :—

Aerofoil	K_L max.	K_D min.	K_M at no lift $(0{\cdot}25_c)$	(L/D) max.
R.A.F.38	0·531	0·0058	− 0·021	20·6
R.A.F.48	0·600	0 0073	− 0 022	19 6

The lift coefficients drop suddenly at the stall particularly so for R.A.F.48, the drop being accompanied by an increase in drag coefficient and a rearward movement of the centre of pressure.

THE INTERFERENCE OF A WIND TUNNEL ON A SYMMETRICAL BODY. By H. Glauert, F.R.S. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1544. (8 pages and 4 diagrams.) May 24, 1933. Price 6d. net.

The problem of the interference of a wind tunnel on the drag of a body has been considered by several authors (*see* list of references), but the subject still remains in a very unsatisfactory state. Lock's analysis*, which is the latest treatment of the subject, is based on the use of a system of images to satisfy the necessary boundary conditions and on the calculation of the corresponding induced velocity experienced by the body. On comparison with experimental results, however, it is found that the theoretical induced velocity must be multiplied by an empirical correcting factor K whose value rises from 1·15 for a symmetrical aerofoil section to 3·13 for a circular cylinder. The empirical curve of this factor, K, as a function of the drag coefficient of the body, rests on very slender evidence, and its magnitude casts doubt on the adequacy of the theoretical analysis. An attempt has therefore been made to examine the problem more closely and to derive a more satisfactory explanation of the observed phenomena.

The whole problem has been reviewed on the assumption that the interference depends partly on the induced velocity of the current theory and partly on a wake correction, analogous to the old choke correction. Experimental results have been analysed to check the validity of this conception and to derive values of the wake correction.

Apart from two anomalous cases, where the experimental results themselves are open to question, the results appear to be consistent with the new dual conception of the interference. The effective width of the wake, affecting the interference correction, is shown to be represented by a single curve against the fineness ratio for all shapes of body.

* C. N. H. Lock. "The Interference of a Wind Tunnel on a Symmetrical Body." R. & M. 1275. (1929.)

INFLUENCE OF WING ELASTICITY UPON THE LONGITUDINAL STABILITY OF AN AEROPLANE. By A. G. Pugsley, M.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1548. (11 pages and 2 diagrams.) January 13, 1933. Price 9d. net.

Discussions of the stability of an aeroplane have hitherto been based upon the assumption that the whole of an aeroplane may be regarded as rigid. Recent work in connection with wing flutter, wing divergence, and reversal of aileron control, however, has drawn attention to the general importance of wing elasticity and led to the suggestion that this elasticity might materially influence the stability of an aeroplane at high speeds.

In the present report the influence of wing elasticity is considered in relation to longitudinal stability. Approximate expressions for the effect of wing elasticity upon each of the relevant derivatives are given and methods of evaluating the terms involved put forward. A numerical example is then discussed and, following a more general consideration of the problem, certain practical conclusions are noted.

Wing elasticity will normally have upon the longitudinal stability of an aeroplane a detrimental effect, which will tend to be more or less dangerous according as the speed of the aeroplane is close to or remote from the divergence speed for its wings. As practical measures for the reduction of this effect, k_{mo} for the wings should be small and the torsional stiffness of the wings large.

FUEL VOLATILITY AND CARBURETTER FREEZING. By W. C. Clothier, M.Sc., Wh.Sch. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1549. (14 pages and 7 diagrams.) February 7, 1933. Price 9d. net.

During the course of tests in connection with the freezing of carburetters some variation between the results of tests with different fuels was noticed and it was decided to develop a piece of apparatus that would measure these differences.

A laboratory apparatus in which a mixture of air and the fuel under test is sprayed on to the bulb of a thermometer, was constructed and measurements were made of the temperature difference between the intake air and the temperature recorded by the wetted thermometer (spray temperature) for a number of fuels.

The spray apparatus provides a simple method of comparing fuels on a basis of their liability to promote freezing. With care absolute measurements may be made, but for most purposes it would be better to compare with a standard fuel. The spray temperature depends on the pressure and temperature of the intake air, and also on the humidity if this is sufficiently high to cause saturation before the final temperature is reached.

Distillation curves give a guide to the relative tendency of fuels to promote freezing but the results are not easy to interpret. The temperature at which 25 per cent. is distilled appears to be on the whole the best criterion.

REPORTS AND MEMORANDA OF THE AERONAUTICAL RESEARCH COMMITTEE PUBLISHED BETWEEN APRIL 1, 1932, AND SEPTEMBER 1, 1933. R. & M. No. 1550. (7 pages.) September, 1933. Price 6d. net.

Previous lists of the Committee's published papers are Reports and Memoranda 650, 750, 850, 950, 1050, 1150, 1250, 1350 and 1450. For a classified list of reports on sale as separate issues, with prices, *see* List B, for which application should be made to H.M. Stationery Office.

AIR SERVICE TRAINING

Progress During November, 1933

ALTHOUGH the month of November is not normally associated with considerable aerial activity, a great deal of useful work was accomplished at the School of Air Service Training at Hamble. In fact, the number of hours flown during the month was more than double that for the same month last year. The variety of examination successes during the month was also noteworthy. Mr. Hollins passed the examination for the 2nd class navigator's certificate, Mr. Beckmann passed the wireless operator's examination, Messrs. Spratt and Mukadam the technical examination for the "B" pilot's licence, Messrs. Mukadam, Ghatge, Hamilton, Mafatia and Kumar obtained their ground engineers' "X" licences for parachutes, Mr. Talbot passed his pilot's "A" licence tests and Mr. Wallace completed a blind-flying course.

Lord Douglas-Hamilton recently joined the School with the object of taking a flying instructor's course and receiving some blind-flying instruction before taking up an appointment with the Hong Kong Flying School of the Far East Aviation Co.

Mr. Dastur, an old pupil of the School, who took various courses at A.S.T. in 1931, returned to take the wireless and navigator's courses. Mr. Dastur flew from India in his "Puss Moth" to join A.S.T., and was accompanied by Mr. Patel, who is to take the course for the "B" pilot's licence.

Other arrivals were Messrs. Finnigan and Dudding for the navigator's course, Mr. G. L. A. France for an advanced flying course and Mr. Jhirad for the navigator's and wireless courses, as well as the "B" pilot's licence.

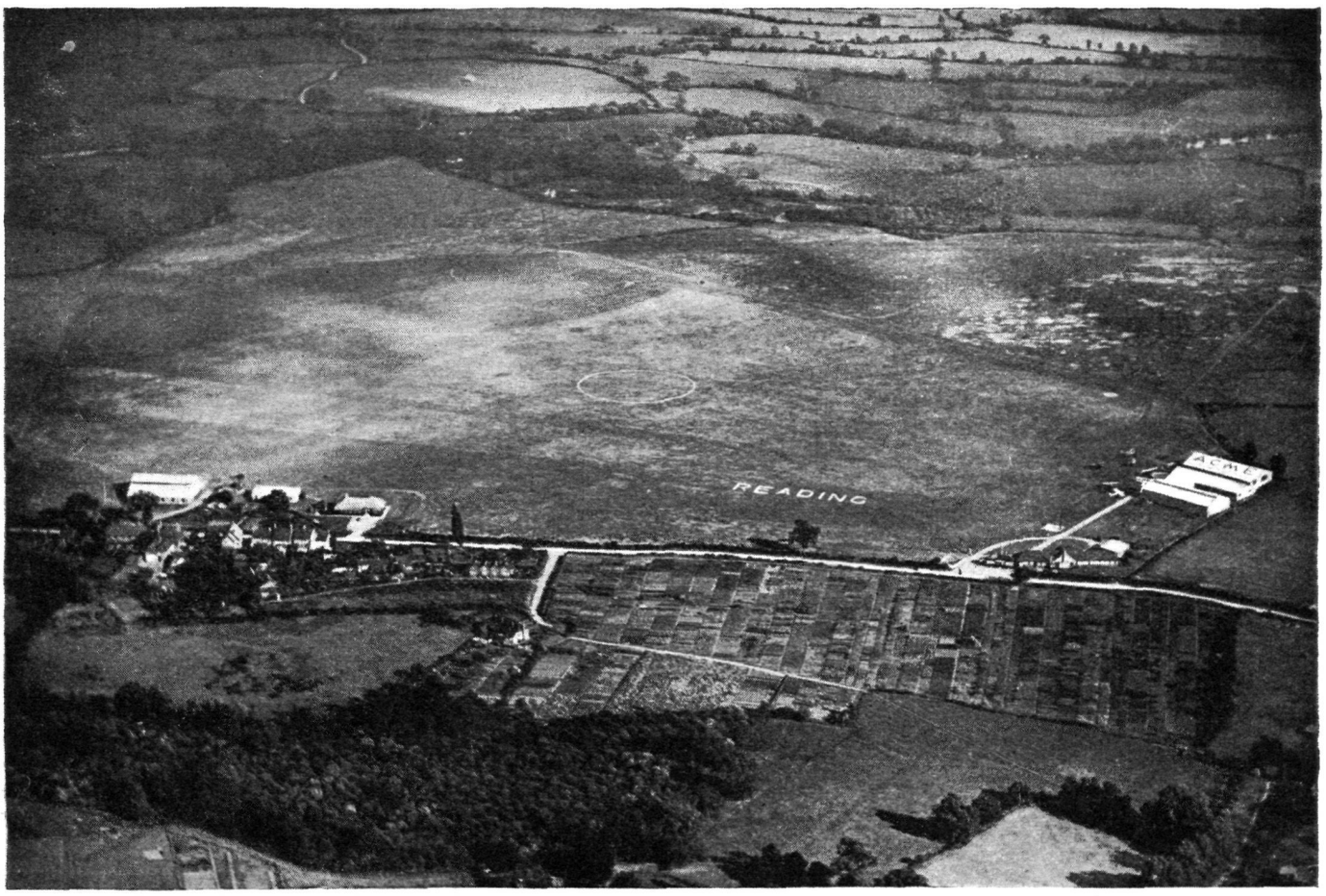
As a result of the success which attended the conversion of a "Cadet" for inverted flying in facilitating aerobatic training two Avro "Tutors" are being modified in this way.

The number of pupils at the School who own their own machines is gradually increasing, although the following will indicate that there is no particular preference as regards types. For example, Mr. Gardner has a "Cadet" and a "Monospar," Mr. Gazdar a Percival "Gull," Mr. Dastur a "Puss Moth," Mr. Spratt a Miles "Hawk," Mr. Aga a "Gipsy Moth," Mr. Whitehead a Spartan and Mr. Greenhalgh a "Sports Avian."

The next long course at A.S.T. commences on January 16, 1934. It is now generally known that these long courses last for about three years, and are intended to qualify the ex-schoolboy—and others—as adequately as possible for a career in aviation. The first of these courses started in the autumn of 1932 with half a dozen pupils, whilst for this year's autumn course there were a dozen new arrivals.

Early in the month the School was re-visited by Countess Frijs of Denmark, who recently obtained her "A" pilot's licence. She was accompanied by Prince Henri of Orleans, who was shown over the School.

The keenest interest is being taken in all sport at the School, association football and hockey matches having taken place each Saturday against various teams. The School squash racquet team has played matches against the R.A.F. at Worthy Down and Calshot and the Miniature Rifle Shooting teams have had a most successful month with matches arranged on an average of three evenings a week.



READING RE-ARRANGED: Arising out of the very rapidly increasing requirements of their business as manufacturers of aircraft (the Miles "Hawk") and the popularity of their School of Flying, Phillips & Powis Aircraft (Reading), Ltd., have now further added to their premises those recently occupied by the National Flying Services at Woodley. They have also acquired the services of Mr. R. Milne, who was previously Chief Pilot to the Berks, Bucks and Oxon Aero Club, and the two clubs are amalgamating, namely, the Reading Aero Club and the Berks, Bucks and Oxon Aero Club. The newly-acquired premises, seen on the left, will be devoted to the housing under the best conditions and at very moderate charges for aircraft of private owners. The offices and stores at the rear of this hangar are being turned into private-owners' rooms, where all facilities will be available in the way of maps, equipment, etc.

THE SECOND INTERNATIONAL EGYPTIAN AVIATION MEETING

(Continued from page 1310)

the ground could in each case be the same. It would appear that a test based on the distance travelled on the glide, after stopping the engine, is, in this case, what is wanted. Another point which ought, on the face of it, also to have been taken into account, is the load when doing this test; pilots were allowed to do it light if they wished to do so, a very different matter from doing it when fully loaded. Of the Take-off and Landing Tests, there is little to be said. The former gave an accurate measure of the distance required by each machine to rise to a height of one metre, as the distance to the first unbroken tape was measured from the tail skid of the machine when on the ground before the take-off. This arrangement did not allow of much trick flying except in the use of brakes, which ought not to be looked upon as trickery nowadays.

The Landing Test, as it had to be made over an object only two metres high, was merely a test of how much the machine could be dropped on to the ground without breaking it, and how hard the brakes could be applied without tipping the machine on to its nose. Both are valuable assets when possessed to a high degree. As, however, there was no restriction against use of the engine, this test was not a true measure of the landing capabilities of the aeroplane except in so far as it showed to what extent the pilot was skilful in holding it in the air, when nearly stalled, and preparatory to dropping it on to the ground. Tests of this nature rather tend to enhance the value of the heavily loaded machine with a flat gliding angle which can be landed short by holding it nearly stalled, though while still controllable, by use of the engine, and then dropping it heavily. An aeroplane of this nature is usually rather difficult to put into a small space without the use of the engine. If the use of the engine were barred, then the clean machine with flaps and slots, giving it a steep but slow glide, at will, would score as many marks as the machine with a high overall drag, but which was sufficiently lightly loaded to have a slow, coarse glide. The former type would, however, win over the latter, when they competed in the take-off-cum-load tests and the distance-covered-on-the-glide test, and this is a reason why all aeroplanes should be fully loaded for take-off and landing tests, in events of this nature.

Morbid-minded people hoped for a few crashes, especially during the landing tests, but they were all disappointed. All pilots, obviously, had no intention of risking their machines before the main event, and for that reason flew them in a normal fashion. The Caudron "Phalene," which forms the majority of the entries, is the French-built machine which is most like our "Puss Moth"; while the engine most commonly fitted, the Renault "Bengali," is not unlike the "Gipsy Major." The performance of this type was therefore watched with great interest, and in almost all cases exceeded the expectations of the lookers-on. Carrying three passengers, it is rather an attractive proposition, especially as it has a very complete equipment, including wheel brakes, engine starter (Viet) and two doors each side making entrance and egress easy. The Potez 43 made the best take-off of the day, as was to be expected, because this type has large fixed wing slots. All the French aeroplanes, and there are now seventeen of them, are painted in the most brilliant colours, thereby adding to the gaiety of the machine park very considerably. The British entries have not, so far, shone much in the Take-off and Landing Tests. This is hardly to be expected, as they consisted of the Avro "626," a "Gull," a "Puss Moth" and the "Hawk Special." Had the "Hawk Special" had brakes it would undoubtedly have done as well as anyone else in the Starting Test, and probably won the Landing Test. As it was, Mr. Cliff landed it shorter than many aeroplanes which had brakes. Sqd. Ldr. F. O. Soden brought his "Puss Moth" in beautifully, and was the only competitor to make a side-slipping, swishy sort of landing. He enhanced the value of his performance by making his second landing a straightforward one, and in both cases was quite short. Mr. Cliff gained distinction by taking the longest time to come down from 2,000 ft., with his engine stopped in the Safety Factor Test, his time being 3 min. 47 sec.

The two Italian entries created extra interest as they are machines of totally different types from the other entries. No. 21, flown by Sig. A. Novelli, is a Savoia Marchetti "S. 80" amphibian, the only amphibian in the competition. It looks a beautiful piece of work, but, having a thick wing of square plan form rather spoils its lines. Its performance as regards take-off and landing was, naturally, not quite up to many of the land machines, but was, nevertheless, very creditable. The other Italian, No. 22, is a Breda "39," the most recent version of the Breda, which it will be remembered Miss Spooner once flew in Germany. Its low wing is fully slotted and flapped. The inner portion of the trailing edge forms a flap which is interconnected to a leading slat of fairly deep chord. The remaining portion of the trailing edge is aileron, and the leading edge has a fully automatic slot. The two-passenger, one-behind-the-other cockpit, is fully covered with a curved cellon cover, which does not appear to give the pilot much outlook forward. This machine did not do particularly well in the Take-off Test and very little better in the Landing Test; it rather gave the impression that the pilot wanted to have a little more experience with it before entering competitions of this nature. In the Landing Test it looked as if he could have landed with less run if he had arrived at the tape on a steep glide instead of flying up to it and dropping over, because when he was doing his Safety Factor Test he certainly made full use of his flaps and slots, and came down slowly and steeply.

Taken all round, these tests went off without a hitch and therefore call for little comment. During their later stages several of the long-awaited and perhaps more interesting aeroplanes arrived. Among these were the red and white Farman 193 of Mlle. Deutsch de la Meurthe, the Farman 234 and 353 of MM. Puget and Lebeau respectively, being both low-wing monoplanes of rather small wing area, they gave an impression of speed as they came in to land. Finally, there were two British-built machines. The first, the "Dragon" (two "Gipsy Majors") of Mr. W. Lindsay Everard and the second the Spartan "Cruiser" (three "Gipsy III's") of the Aeroput Company of Yugoslavia. The former machine was almost given up as it has encountered exceptionally bad weather; so much so that Mr. Everard, who is one of the delegates to the F.A.I. Conference, considered it wiser that he should leave the "Dragon" at Dijon, proceed by train to Brindisi and thence by Imperial Airways to Alexandria, in order to make sure of getting here in time for the Conference. Everyone is glad that the machine has got through in time, as Mr. Macpherson, his pilot, has had a very bad time in doing so. The "Dragon" should, by the formula, stand a very good chance of doing well in the competitions. His arrival brings the number of British participants up to five, not a very imposing one, in the face of seventeen Frenchmen. Of the other British entries, Mr. Gardner was unable to get his "Monospar" ready in time, and therefore flew out in his "Cadet," and is not taking part in the competitions; Mr. Robson, Lady Hay Drummond-Hay and Mr. Beardmore are understood to have had engine trouble on the way out, and Mr. Spratt damaged his machine in Switzerland before starting the outward journey. Nothing has been heard of the other entries. To-morrow we shall see the remainder of the preliminary tests, and the Circuit of the Oases will start on Wednesday morning.

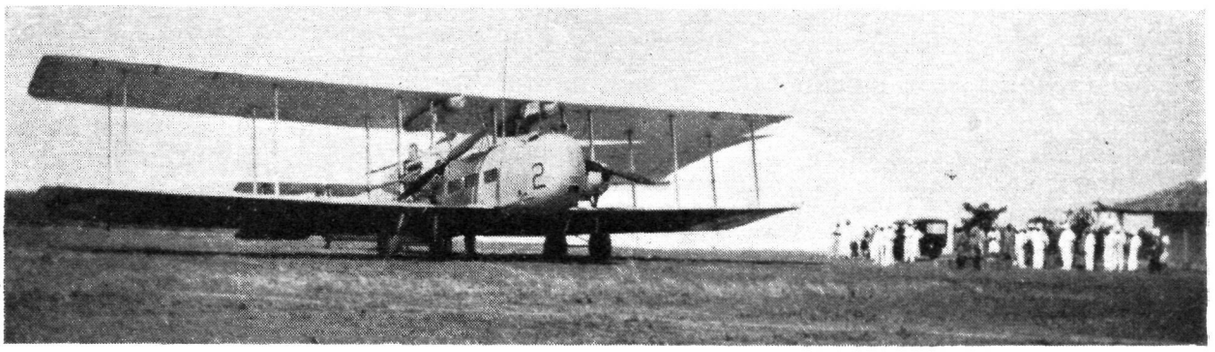
Late News

Just as we are going to press it is learnt that Mr. Lindsay Everard's "Dragon" (2 "Gipsy Major") was the winner of the Oases Circuit and of the Oases Trophy. The speed race is reported to have been won by Mr. Guy Robson on a Percival "Gull" fitted with Napier "Javelin" engine, whose average speed over the course was 225.56 km./h. (140 m.p.h.). This indicates that Mr. Robson managed to arrive in time (after the posting of our representative's letter) and to put up a very good performance.

Junkers reports in 1933

THE annual report of the Junkers Flugzeugwerke A.-G. shows a notable improvement in comparison with last year. Machines sold abroad were mostly of the Junkers "Ju 52/3m" and "W 34" types. The chief purchasers were the South American countries, the Far East, Canada and the Union of South Africa. Large orders have also been received from Deutsche Lufthansa.

Airisms from the Four Winds



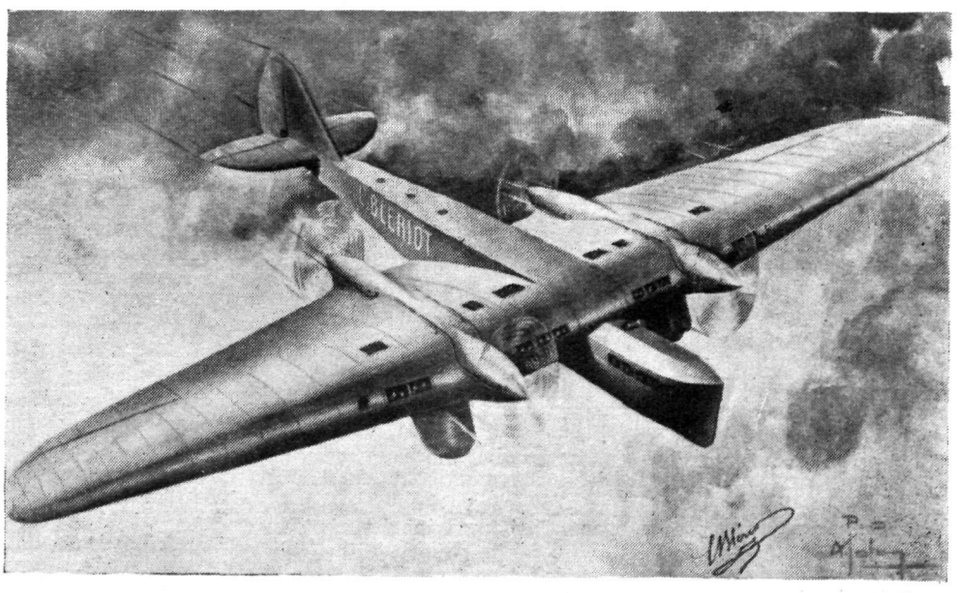
A SERVICE CRUISE : One of the Vickers " Victoria " troop carriers of No. 216 (Bomber Transport) Squadron, R.A.F., landing at Tambacounda during the flight to West Africa.
(Photo, Courtesy Shell Mex & B.P., Ltd.)

R.A.F. West African Flight

THE R.A.F. West African Flight arrived back at Heliopolis on Monday, December 18. Over 12,000 miles have been covered on the journey to Bathurst and back, which included visits to French Equatorial Africa, Nigeria, the Gold and Ivory Coasts, Sierra Leone and Gambia. The personnel and machines were picked from No. 216 (Bomber Transport) Squadron, stationed at Heliopolis, Cairo, the machines being Vickers " Victorias " with Napier " Lion " engines. While in the Gold Coast the machines were employed to transport three officers and 56 men of the West African Frontier Force from Tamale to Accra, a practical example of the work for which these machines are intended ; not only the men were transported, but their equipment, which included machine-guns and ammunition. This flight has an especial interest in that it is probably the last flight of this sort to be done on " Victorias " fitted with the Napier " Lion." The " Lion " has done sterling work in the R.A.F. over a long period, and perhaps no machine will be better remembered in connection with it than the " Victoria." The " Lion " has enjoyed a wonderful record in the Service, and has to its credit the early prospecting flights over the air mail track to Baghdad. Service pilots will regret the passing of the " Lion," especially from the " Victoria," but no doubt Napiers will some time in the future produce another engine which will enjoy the same reputation, and in which R.A.F. pilots will be able to put the same trust.

Bleriot's latest conception

M. LOUIS BLERIOT, whose aircraft works are now closed, has designed a trans-oceanic machine. He maintains that the hull and floats of an aircraft are " dead weight," but admits that land-planes are not suited to long ocean crossings ; so he has sought to create a compromise. In his new design the foremost part of the fuselage is boat-shaped, the " boat " being detachable when necessary. Quite a number of other interesting details of the aircraft may be noted in our illustration.



BLERIOT'S LATEST: M. Louis Bleriot, the famous French Air pioneer, has considered the possibility of constructing a powerful plane for passenger transport, in which will be incorporated a new type of safety device. In the forepart of the fuselage is a life-boat fitted with an engine, which will automatically be released as soon as the plane alights on the water, in the event of a forced landing, and thus convey the passengers safely to land.

The Lindberghs arrive at New York

ONE of the longest survey flights ever undertaken was completed when Col. Lindbergh and his wife landed at North Beach Airport at 2.40 p.m. (local time), on Wednesday, December 20. They have been flying a Lockheed " Sirius " monoplane, powered with a Wright " Cyclone " engine. It is estimated that nearly 30,000 miles have been flown, which includes crossings of the North and South Atlantic. On Col. Lindbergh's arrival at New York he was met by Mr. G. W. Vaughan, President of the Wright Aeronautical Corporation. Commenting on the engine used in the flight, Mr. Vaughan stated that it was a 715-h.p. Wright " Cyclone F." nine cylinder. It weighed about 1.22 lb. per h.p. It is expected that Col. Lindbergh's report to Pan-American Airway Company will supply information of international importance regarding the question of trans-ocean flying. This flight only goes to prove what has been realised for some time now, namely, the wonderful ability of Col. Lindbergh as a pilot and navigator. Col. Lindbergh, it is announced, is presenting his seaplane to the American Museum of National History.

French African flight

THE French African flight was brought to a successful finish on Monday, December 18, when General Vuillemin landed at Algiers, followed by the rest of the machines. M. Pierre Cot, the French Air Minister, and M. Delesalle, Under-Secretary of State, who had flown together from Paris, were on the aerodrome to meet them. At a Champagne d'honneur which was given to the crews of the

machines M. Cot congratulated General Vuillemin on behalf of the French Government.

The flight has covered a distance of some 15,000 miles in the last five weeks. Thirty machines originally set out; they were Potez 25, T.O.E. 1933 type, specially adapted for colonial conditions, and have a range of 750 miles. They are equipped with 450-h.p. 12-cylinder Lorraine-Dietrich engines, which consume petrol at the rate of 48 gall. an hour; they were designed by M. Barbaroux.

Capt. Olly resigns

CAPT. GORDON OLLY, one of the best known of Imperial Airways pilots, has resigned. It is understood that he intends to start on a private venture of his own. His resignation will not take effect for another three months.

A stratoplane

IT is reported from Brussels that a machine is being built for a proposed ascent into the stratosphere next year. No details are given, but it is understood that several professors of the Faculty of Science in Brussels University are superintending the construction, assisted by M. Piccard and M. Allard.

Non-stop round-the-world flight

IT has been reported in one of the Sunday papers that a flight of the most ambitious nature is being contemplated. It is nothing less than a flight of 24,000 miles round the circumference of the globe following a longitudinal axis. The flight will be done without landing, refuelling taking place while in flight. Neither the machine nor the route have been chosen. Three names have been connected with the project, Lady Houston, Col. P. T. Etherton and Lt. Col. L. V. S. Blacker.

Longest charter flight

THE longest charter flight yet recorded came to an end on Tuesday, December 26, when the Spartan "Cruiser" piloted by Mr. Lynch-Blosse landed on the sands near Clacton. The machine was chartered by Capt. Crawford Greene and has flown nearly 32,000 miles to Australia and back since October 9, when it left Worcester. Capt. Crawford Greene remained behind in India, but his companion, Lord Apsley, returned to England with the machine. Apparently the last lap of this flight gave the control tower at Croydon some anxious moments, for the pilot flew from Lyons with no intermediary landing, in fact, he did not spot land after leaving Lyons until over Clacton. Shell fuel and oil were used both out and home.

Stag Lane to Spain—*via* Coventry

ON Friday of last week four "Tiger Moths" left Stag Lane with the intention of flying to Spain, the first stop being Lympne. The English fog proved too much for the pilots and it was some time before three of them arrived, after having been separated from each other. The fourth pilot developed an unnatural desire to view England's industrial centre from the air; he landed at Coventry. His curiosity satisfied, he flew to Lympne to join his comrades.

Flight over Antarctic

ADMIRAL BYRD, on Friday, December 22, flew over unchartered seas further than 70 deg. south, thus passing Capt. Cook's reputed southernmost record. It is reported that he found a sea where no sea should be.

Lord Wakefield's Gift

AMONG subscriptions already received for the purchase of the *Codex Sinaiticus*, the oldest Bible in the world, is one from Lord Wakefield for £1,000.

"Shell Aviation News"

FOR the past two years our good friends Shell Mex & B.P., Ltd., have circulated, for the benefit of the aviation departments in the Shell Group throughout the world, a brochure known as *Shell Aviation News*, containing items of news concerning current happenings in the aviation world. These monthly bulletins were always interesting and excellently compiled, and of late increased considerably in bulk—and, of course, in the range of information therein. Hitherto, *Shell Aviation News* has been typewritten, but the current (December) issue, now before us, has appeared in full print. While, in its new form, its bulk has consequently lessened, the quantity and quality of the information presented is of the same high standard. We congratulate Shell Mex & B.P., Ltd., on this excellent and really useful record of aviation events.

Airport News

CROYDON

THE week preceding Christmas was one of fog and bad flying weather on almost all air routes. Although it compared unfavourably with last year in this respect, passenger traffic was up to last year's standard, and December figures for 1933 compare favourably with those of 1932 up to date.

One incident early in the week was a fog at Croydon so thick that the K.L.M. Fokker due to depart at 08.20 had to be taxied from the hangar to the tarmac with navigation lights burning in case other machines were being man-handled or tractor-towed through the fog. This particular machine had the good luck to get away along the white line just before the fog closed down. The reason why it was able to leave was because one of Holland's alternative airports, Twente, had a visibility of 4 km., although Rotterdam and Amsterdam were in thick fog. The same day, however, an aeroplane not bound for Croydon left Paris at a time when there was little hope of getting in anywhere in England and, after some hours of flying, had to return to its starting point.

An interesting air trip was made during the Christmas period by Miss Brooke, the Fashion and Beauty Editor of a leading illustrated weekly paper, who is said to be between 70 and 80 years of age. She flew to Delhi in order to spend two days in India, and then returned by air. I understand that she spent most of Christmas Day in the air between Brindisi and Athens, where she was regaled with seasonable good cheer by Imperial Airways, Ltd.—turkey, plum pudding and, they say, even a Christmas tree in the cabin. Her gift from the company was an Imperial Airways' diary with her name on the cover in gold letters, a jolly souvenir of a pleasant trip.

Another passenger who spent Christmas in the air, between Khartoum and Juba, was a schoolboy on the way home to Nairobi. I hope Imperial Airways laid in a good stock of mince pies, etc., for him.

Owing to the sudden way the fog kept closing down at various places last week, all sorts of machines have been arriving at different ports of refuge. Gravesend has been used quite a lot by K.L.M., D.L.H., and Hillman's, and on three days Hillman machines have been seen at Croydon.

In England, Biggin Hill has been used as an emergency landing place, and in Holland, the military aerodrome of Soesterburg. In France, St. Inglevert and Abbeville have proved useful to commercial machines. With all this it is amazing how very little interruption there has been in air communication, and there have been few disappointed passengers.

Considerable anxiety is being expressed during this period of bad weather about the continued presence of that dangerous obstruction at the London Terminal Airport, the radio beacon mast. Originally placed in the wrong position by the authorities, who failed to consult the majority of the companies concerned before its erection, it has been a serious menace to air traffic ever since. Pilots who know the aerodrome well keep it ever in mind, but would heave a sigh of relief if it were removed. What the authorities may not realise is that quite a number of pilots unfamiliar with the airport are making use of it this winter in shocking weather. If a serious accident happens owing to this obstruction, doubtless it will be hurriedly removed the very next day. Are we to wait for this?

By the way, I ought to mention that one weather condition which has caused several machines to land at ports of refuge lately has been that unpleasant phenomenon, "ice formation." I do not know if the various Canadian and American gadgets to prevent it are reliable in practice, but in Europe we have no means of combating it. Thank goodness it is a very rare occurrence.

A. VIATOR.

POSSIBLE FUTURE DEVELOPMENTS OF AIR-COOLED AERO ENGINES*

By A. H. R. Fedden, M.B.E., F.R.Ae.S., M.I.A.E., M.I.M.E., M.S.A.E.

(*Concluded from page* 1294)

SUMMARISATION OF IMPORTANT FACTORS GOVERNING AIRCRAFT ENGINE DESIGN

To sum up, I suggest that the most important factors governing the development of air-cooled aero engines, during the ten to fifteen years' period under review, fall under the following headings:—

(1) That, short of some quite revolutionary discovery, the bulk of aero engines for sport, civil work, and for general purpose military aircraft, will remain electric-ignition petrol engines of the four-cycle type, retaining pistons, cranks, and connecting rods.

(2) That better quality fuels will be employed on aircraft engines, permitting increase in compression ratio, brake mean effective pressure, and improved fuel economy.

(3) That present-day engines will be looked upon as bulky, cumbersome, and altogether too large for their power output, and that just as to-day a full-size touring car is doing better work with an engine of half the swept volume of the corresponding vehicles of fifteen years ago, so we shall find that aircraft will be putting up improved performances with engines of considerably less swept volume than those which are employed to-day.

(4) That all aircraft engines, even of the sports type, may employ some sort of blower. Military engines will use a high supercharge to restore and maintain power to considerable heights, while civil engines will use a blower of lesser compression ratio to restore normal power to moderate heights.

Military aircraft, requiring engines maintaining power to a considerable altitude, will eventually have to use a multi-stage centrifugal blower with inter-coolers, and, if this does not "fill the bill," we may go back to the exhaust turbo compressor, but, with the recently introduced enrichening device for take-off, the present rate of supercharge, giving a rated altitude of 15,000 ft., may suffice for some considerable period, as it is quite possible that it will be found that the present supercharged military engine is ahead of some of the equipment of the aircraft.

(5) That with an increase in efficiency of aircraft engines, and the general use of supercharging, important alterations and developments will be required in cylinder and piston design.

(6) To meet the demand of output from a smaller volume, it will be necessary to increase considerably the crankshaft rotational speed, and modifications will have to be made in the design of crankshaft, bearings, and valve mechanism, while there is a possibility of the poppet valve being superseded altogether. If, however, the poppet valve is retained, additional technique and expense will have to be incorporated into the manufacture of this component.

(7) That all engines, except possibly those of the smallest type, will be fitted with reduction gearing to the propeller shaft, and, to maintain propeller efficiency with high crankshaft rotational speeds, the higher powered engines will employ ratios greater than 2:1.

(8) That for certain types of aircraft a variable-pitch propeller will be standardised during the period under review. The controlled speed type is favoured, but it is desirable, to achieve practical results, that this device should be incorporated and built into the design of the engine.

(9) That the general tendency of military engine design demands a more severe type test procedure than at present, and that an appreciable period of the type test should be occupied in running at maximum revolutions, and in excess of maximum revolutions. The civil type tests should be run continuously at maximum revolutions.

(10) That within the period under review, the necessity will arise for a much larger aircraft power unit, and that when this matures it may be of the compression-ignition type.

I will endeavour to tabulate the most useful types of aircraft power plant, as follows; and I would like to say a few words on each:—

(*a*) Sports and training—light type engine.
(*b*) Small civil type engine.
(*c*) Intermediate civil and military type engine.
(*d*) Current type military and air liner engine.
(*e*) High power high efficiency military type engine.
(*f*) Large flying boat and large air liner type engine.

Category (*a*)—Light Type Engine

For this type of engine air cooling is supreme, and I suggest that it will remain so. The question of price is of paramount importance. Owing to a combination of factors such as ease of production, low first cost and maintenance, ease of cooling of small cylinders, narrow bodies, etc., the four-cylinder in-line engine up to 130 h.p. seems to be the most suitable compromise, and has given every satisfaction in service.

Fig. 27 shows a composite picture of the four-cylinder 130-h.p. inverted "Gipsy Major," the 140-h.p. seven-cylinder Armstrong-Siddeley "Genet Major" and the six-cylinder in-line Napier "Javelin" of 155 h.p. The first two are well-known production types, while the "Javelin" engine, recently introduced by the Napier Company, embodies some interesting and up-to-date features for air-cooled in-line engines, such as overhead camshaft, modern cylinder finning, etc.

For several reasons the six-cylinder engine is extremely attractive when considering the high-power end of the scale of this category, and, undoubtedly, this type of engine has a future in certain specialised types of aircraft; but, seeing that we are discussing the very cheapest aircraft power unit possible, and considering the extra length and weight of the crankshaft and crankcase, I suggest that it is doubtful if the weight and cost of this type can be afforded for general use. I think, therefore, that we shall see the

* Abstract of paper read before the Royal Aeronautical Soociety on December 7, 1933.

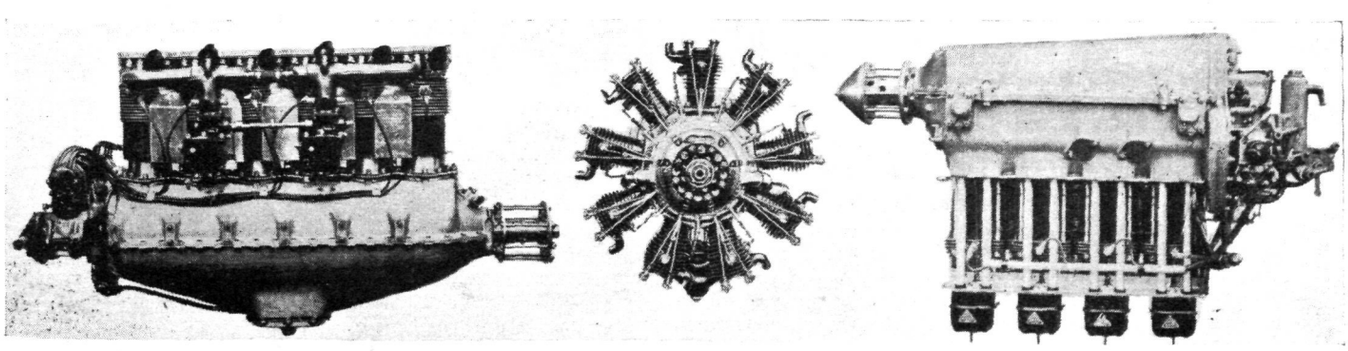


Fig. 27: The Napier "Javelin," Armstrong-Siddeley "Genet Major" and de Havilland "Gipsy III" engines.

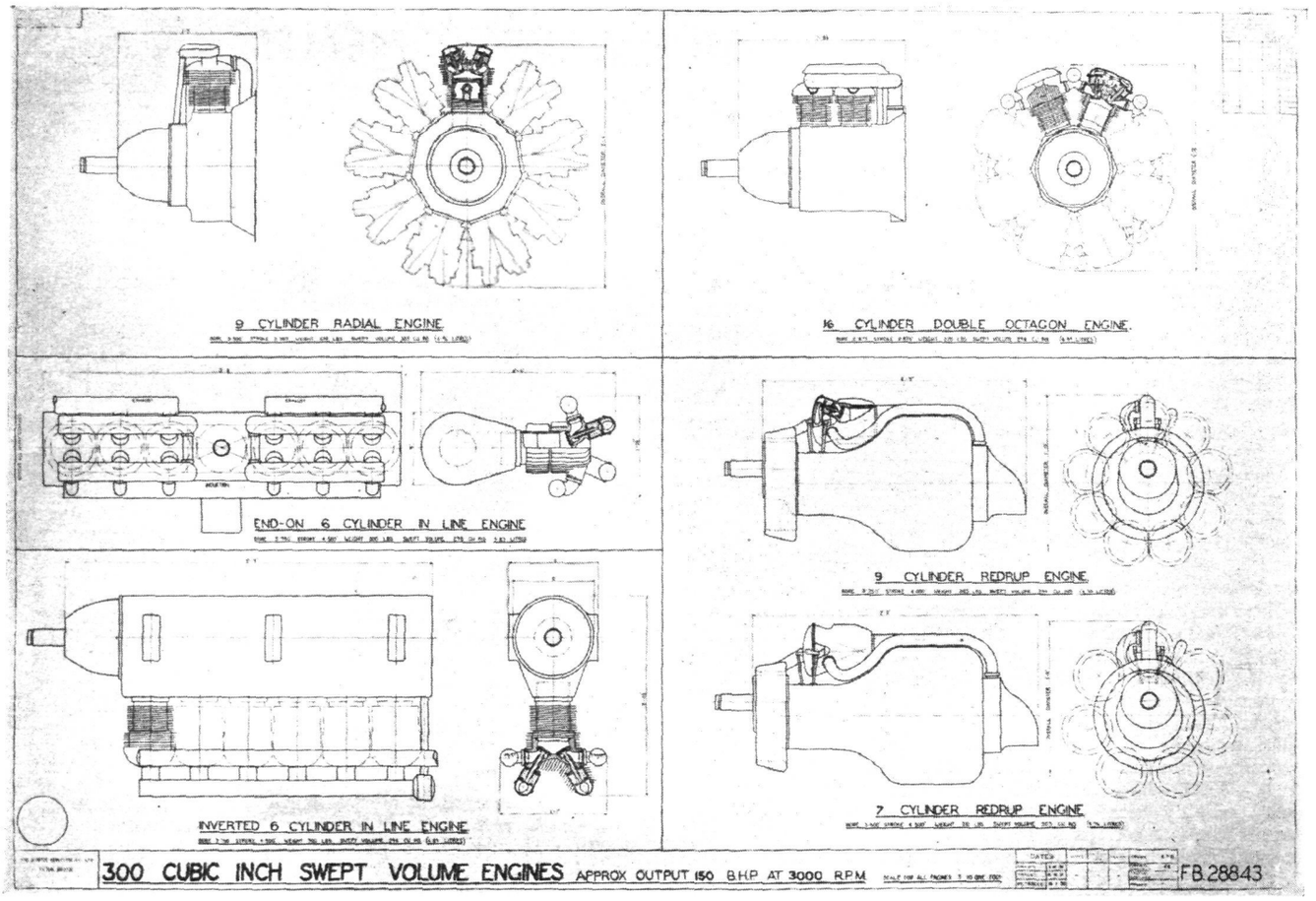


Fig. 28 : Comparative layouts of air-cooled engines of approximately 300 cu. in. swept volume.

four-cylinder in-line a healthy competitor in this class for some time to come, and that when it is necessary to increase the power, I am in favour of the radial as typified by the Armstrong-Siddeley "Genet Major."

The average capacity of this category of engine, at the present time, is approximately 6 to 7 litres (366 to 427 cu. in.), and I suggest that we should aim at reducing this by 25 per cent.

In this category, where prime cost is of such vital importance, I expect to see some determined efforts made to break new ground, and it would appear that the two-stroke direct petrol-injection engine might prove a possible solution.

Category (*b*)—Small Civil Type Engine

There seems to be some interest in Europe in the small economical twin-engined passenger machine, carrying eight to ten passengers, and, if this type of civil aircraft becomes popular, the civil engine of 200 to 225 h.p. will become an important category. It may also be used for training purposes. I believe it will be air-cooled, and I suggest that the best solution will be a nine-cylinder radial.

Some two years ago the Bristol Company investigated such a type of engine, and Fig. 28 shows the layout of the types reviewed.

(1) The nine-cylinder air-cooled radial.
(2) The 16-cylinder double octagon engine.
(3) The six-cylinder inverted engine.
(4) The six-cylinder horizontal engine for fitting into the leading edge of a thick wing.
(5) The seven-cylinder "Z" crank engine.
(6) The nine-cylinder "Z" crank engine.

Quarter-scale models of these engines were made and investigated by Capt. Barnwell in the Bristol Company's wind tunnel, from the point of view of drag, mounting, cowling, accessibility of installation, etc., while the Company's engine department looked into the design of these six engines, cooling possibilities, weight, cost of manufacture, etc.

Taking into consideration all factors, the nine-cylinder single-bank radial proved the most promising solution. It is worth noting that the "end on" six-cylinder engine, so much discussed on the Continent at one time, as a low-drag type, proved to be unsatisfactory owing to wing interference.

I suggest that this category of engine may prove a useful type, and should be of 5 to 6 litres (305 to 366 cu. in.) capacity.

Category (*c*)—Intermediate Civil and Military Type Engine

This category of engine of approximately 300 to 400 h.p., and 15 litres (915 cu. in.) capacity, has, in the past,

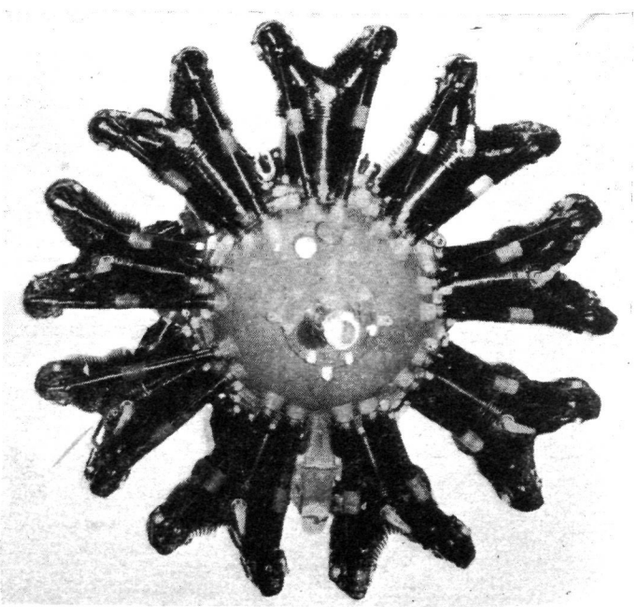


Fig. 29 : The Pratt & Whitney "Wasp Junior."

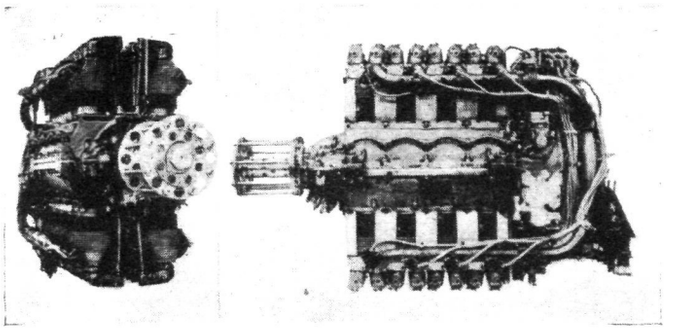


Fig. 30 : The 16-cyl. four-bank Napier " Rapier."

been mainly employed for civil work, and will, I suggest, continue to hold a prominent position in this field, but with the possible introduction of a high performance twin-engine fighter aircraft, this engine may prove an important military category in high efficiency form with gearing and supercharging. Up to the present time the single-bank air-cooled radial has proved the most satisfactory type, and I suggest that the nine-cylinder radial offers the most promising solution for the future.

The advantages of the single-bank radial in regard to simplicity of manufacture, accessibility, maintenance, cooling, stiffness, light weight, etc., afford, in my opinion, definite advantages over and above the multi-bank type.

Fig. 29 shows a view of the Pratt & Whitney " Wasp Junior," which is a fine example of this type of engine.

In this category I suggest that we shall see the swept volume reduced to about 8 to 9 litres (488 to 549 cu. in.), a considerable increase in rotational speed of the crankshaft, a change in the valve operating mechanism, and the introduction of airscrew reduction gearing.

Fig. 30 shows two views of the Napier " Rapier " 16-cylinder four-bank in-line air-cooled engine, typical of this latter class. This engine, designed by Maj. Halford, is an extremely interesting type, and is, I believe, the first effort to produce a high performance air-cooled engine running at high revolutions per minute, and with considerable output per unit volume.

I consider we may expect the military rating of this category raised above 400, and, seeing that the engine capacity for the Coupe Deutsch de la Meurthe, an important bi-annual Continental race, is 8 litres (488 cu. in.), I expect to see considerable development in this category.

Category (*d*)—Current Type Military and Air Liner Engine

Under this heading—current type military and air liner engine—I suggest that the air-cooled engine will continue to have a wide field of operation.

Fig. 31 shows an example of the Bristol " Pegasus " engine by the side of the American Wright " Cyclone " engine, shown for the first time in Europe at the Paris Salon last December.

I fear that my audience may feel I am somewhat prejudiced towards the nine-cylinder air-cooled radial engine. This is almost unavoidable, but I am convinced there is a great deal in favour of this engine, and that it will still have a considerable life in the aviation world. For a given volume, I believe it to be lighter and more easily cooled than the multi-row engine. For a given weight it can be made stiffer in construction ; it should be better from a production and maintenance standpoint, simpler to cowl and to arrange with an efficient exhaust manifold system, while the machine-gun clearance on a single-engined aircraft can be more easily provided ; and, although I realise that as powers increase, more than one row must be faced for the large air-cooled radial engine, I recommend that the single-row radial is retained as long as possible, and that the number of rows of cylinders should be kept down as low as possible.

Distribution should be easier with the single-bank type, and, with the increase of speed that has already been satisfactorily achieved, any previous difficulties of torque recoil have been eliminated at the powers of this category.

The American engine made an excellent impression at the last Paris Salon, and a comparison of the English and American train of thought, with these two identically similar types, is worth noting. The English engine is of smaller capacity than the American by about 1.2 litres (73 cu. in.) and the power and specific weight, based on a similar octane value fuel, are approximately the same. Both engines have recently been type tested and re-rated with 87 and 92 octane value fuels respectively. The English engine has a forged cylinder head with four valves and a maximum crankshaft speed of 2,500 revolutions per minute, a reduction gear to the propeller shaft of 2 to 1, and usually employs a two-blader wooden propeller. The American engine employs a cast head with two large hollow-headed sodium cooled valves, with a maximum crankshaft rotational speed of 2,050 revolutions per minute, and is produced as a direct drive engine, and also with a gear ratio of 3 to 2, and employs a three-blader metal airscrew. It will be interesting to see how these two similar types of engine develop.

It is probable that, during the period under review, we shall see engines of this category developing 750 h.p. from 16 to 20 litre (976 to 1,220 cu. in.) capacity, running at over 3,000 revolutions per minute, and with reduced weight and overall diameter, but I expect to see push rod valve mechanism replaced.

Category (*e*)—High-Power High Efficiency Military Type Engine

Under this heading I suggest that a suitably developed air-cooled engine may hold an important position in the future for military aircraft. In this category, however, keen competition must be expected from the liquid-cooled engine, which can only be met by suitable layout and most careful detail design. I suggest that the wisest course is to endeavour to concentrate on the advantages of the direct air-cooled engine, and considerable care must be given to light weight, ease of mounting and installation, accessibility, and maintenance. High output per unit volume, and high crankshaft rotational speed must, I suggest, be faced in this category to meet competition.

From experimental work the Bristol Company have been carrying out during the past two or three years, I am convinced that it is important to keep to a minimum the number of rows of cylinders for an air-cooled engine operating at high output and high crankshaft revolutions, and with a high rate of supercharge ; and any attempts to draw comparisons from existing in-line light aeroplane engines may be erroneous.

Direct air-cooled cylinders require exactly the same weight of air to cool them efficiently whether disposed radially or in-line, and when in-line they must be suitably spaced and baffled, and are more prone to be upset by varying cooling conditions in different installations.

Research work by the Bristol Company has shown that it is extremely difficult to cool highly supercharged cylinders satisfactorily at full throttle for a sustained period, when more than three in a line, even when of comparatively small bore, at the low air speeds that must be faced in fully cowled installations.

Engines of this category will have to operate in heavily loaded machines with continuous high cruising output, and for the above reasons I do not favour the multi-bank in-line air-cooled engine for these powers, as it would appear that it must emphasise some of the problems of the in-line liquid-cooled engine, of equal swept volume, in an exaggerated form, in respect of simplicity, weight, length of crankshaft and crankcase, ease of installation, etc., while

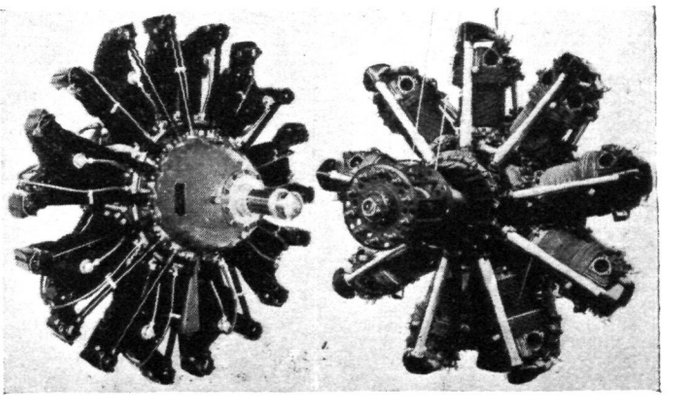


Fig. 31 : The Wright " Cyclone " and the Bristol " Pegasus."

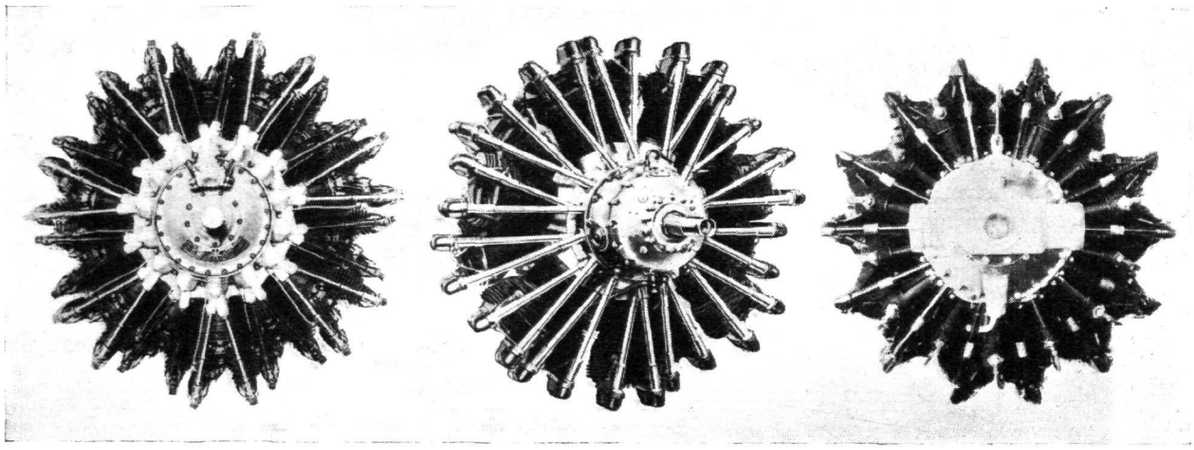


Fig. 32 : Double-row radials. The Armstrong-Siddeley "Tiger" between a French Gnome K.14 "Mistral Major" and a Pratt & Whitney "Twin Wasp."

still having to meet at least as serious, and probably greater, cooling difficulties as on the radial type.

I suggest that the most promising solution is the double row radial in compact form.

There is at present a strong school of thought both in Europe and America in favour of the 14-cylinder double row staggered radial engine for this category, and Fig. 32 shows a composite picture of the British Armstrong-Siddeley "Tiger" engine of 32.7 litre (1,994 cu. in.) capacity, the French Gnome "K.14" engine of 38.6 litre (2,360 cu. in.) capacity, and the Pratt & Whitney engine of 30 litre (1,830 cu. in.) capacity, representative of the most advanced conceptions along these lines, and it will be interesting to watch the development of these similar types. Fig. 33 shows side views of the Gnome "K.14" and the Pratt & Whitney "Double Wasp" types. Although externally it would appear that all three engines present a strong family likeness, the American design differs considerably from the European types in several respects, the crankcase being built up of three forgings, with a central division wall, and it is of smaller swept volume, and would appear to have been laid out along the lines of high-speed development.

I suggest that if the air-cooled engine protagonists are going to hold the field against the liquid-cooled engine in this category, where high efficiency will probably count more than in other types of aero engines, and light weight, compactness, and low specific fuel and oil consumption are of the utmost importance, neither the staggered radial nor the multi-bank in-line air-cooled engine may be the ultimate solution. I suggest instead the double bank in-line engine as first seen in the design of the Curtiss "Chieftain" of some years ago. This layout lends itself to the use of both sleeve and overhead camshaft valve gear, one of which will be necessitated if a considerable increase of crankshaft rotation is to be satisfactorily employed, and it also enables a very stiff crankcase construction to be achieved.

During the period under review I suggest that there will be a call for an engine of this type of 850 to 950 h.p., which should develop its power from 20 to 25 litre (1,220 to 1,525 cu. in.) capacity.

Category (*f*)—Large Flying-Boat and Large Air Liner Type Engine

Finally, with regard to the really large power plant for projected marine and civil aircraft, I am afraid that I have no slide from which to draw upon my fancy, but I suggest that, during the period under review, there will be a demand for a power unit of 1,000 h.p. to 1,200 h.p. which may be met by an air-cooled engine.

Owing to the size of the aircraft, scale effect will come into the layout, and cooling conditions may not, therefore, be so severe, but considerable attention must be paid to fuel consumption, and the engine must be capable of running for long periods without attention or maintenance.

If such an engine is required within the next five years, I think it must be of the four-cycle petrol type, but I would suggest that the most hopeful solution may be the compression ignition or Diesel engine of the two-cycle type, and of large swept volume of the order of 55 to 65 litre (3,355 to 3,965 cu. in.) capacity, and capable of maintaining a continuous cruising horse-power of 800 to 900.

I am afraid these notes only provide a very precursory review of possible air-cooled aircraft engines for the future, but I hope they will provide some "food for thought."

I wish to thank the British Air Ministry, the Bristol Company, and other constructors, for their permission to make use of certain data and to exhibit slides of their products.

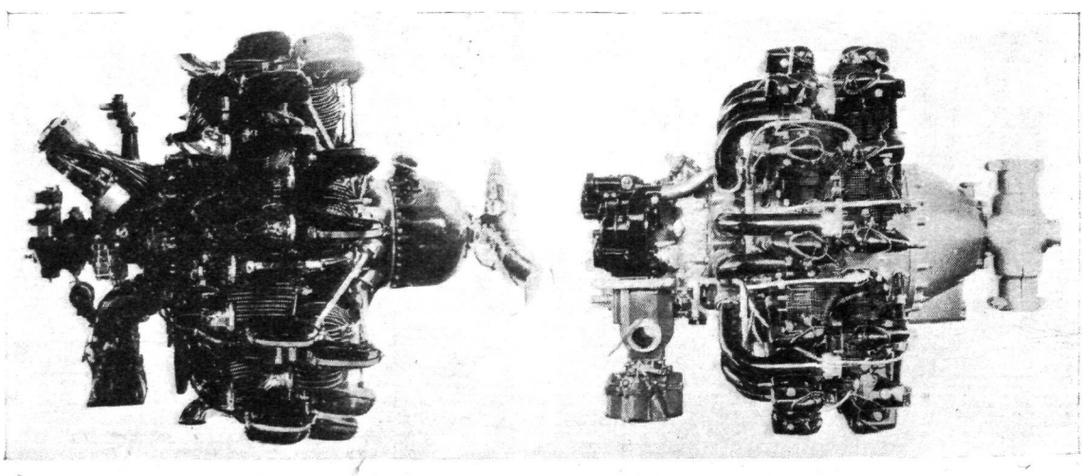


Fig. 33 : Side views of the "Mistral Major" and "Twin Wasp."

THE ROYAL AIR FORCE

London Gazette, December 19, 1933

Air Marshal Sir R. Brooke-Popham, K.C.B., C.M.G., D.S.O., A.F.C., is appointed Principal Air Aide-de-Camp to the King (Dec. 1) (vice Air Chief Marshal Sir E. L. Ellington, K.C.B., C.M.G., C.B.E.).

General Duties Branch

Lt. H. C. Ranald, R.N., is reattached to R.A.F. as a Flying Officer with effect from Dec. 10 and with seny. of Aug. 2, 1927. The follg. Pilot Officers on probation are confirmed in rank (Nov. 28) :—P. B. H. Butler, W. B. Fleming, E. L. A. Walter.

Flt.-Lt. G. L. Ormerod is placed on retired list on account of ill-health (Dec. 17) ; Lt.-Comdr. S. Richardson, R.N., Flt. Lt., R.A.F., relinquishes his temp. commn. on return to Naval duty (Nov. 30); the short service commn. of Acting P/O. on probation C. E. L. Wray is terminated on cessation of duty (Dec. 18).

Dental Branch

F/O. E. Sharp, L.D.S., is promoted to rank of Flt. Lt. (Dec. 14).

Chaplains Branch

C. R. Richardson is granted a short service commn. with relative rank of Sqdn. Ldr., with effect from and with seny. of Dec. 4 ; the Rev. K. C. H. Warner, D.S.O., M.A., resigns his permanent commn. (Dec. 14).

PRINCESS MARY'S ROYAL AIR FORCE NURSING SERVICE

Staff Nurse Miss A. M. Williamson is promoted to rank of Sister (Nov. 3).

ROYAL AIR FORCE RESERVE
RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The follg. Flying Officers are promoted to rank of Fl. Lt. (Dec. 1) : —G. S. Brown, C. A. Goatcher, R. T. Halliwell, C. C. Thurrell.

F/O. H. V. Bullock is transferred from class B to class C (Dec. 15) ; F/O. S. L. F. St. Barbe relinquishes his commn. on completion of service (Dec. 15) ; Flt. Lt. S. D. Scott relinquishes his commn. on completion of service and is permitted to retain his rank (Nov. 8).

SPECIAL RESERVE

General Duties Branch

P/O. on probation J. L. C. Newton is confirmed in rank (Nov. 19).

AUXILIARY AIR FORCE

General Duties Branch

No. 603 (City of Edinburgh) (Bomber) Squadron.—P/O. J. G. E. Haig is promoted to rank of Flying Officer (Dec. 11) ; P/O. G. H. Gatheral relinquishes his commn. on appointment to a short service commn. in R.A.F. (Nov. 1) (substituted for *Gazette* Nov. 21).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Wing Commanders : G. B. A. Baker, M.C., to Station H.Q., North Weald, 14.12.33, to Command, vice W/Cdr. R. H. G. Neville, O.B.E., M.C., R. H. G. Neville, O.B.E., M.C., to H.Q., Central Area Abingdon, 14.12.33, for Air Staff duties.

Squadron Leaders : C. F. Le Poer Trench, to No. 11 (B) Sqdn., Risalpur, India, 25.11.33, to Command, vice S/Ldr. R. T. B. Houghton, A.F.C. H. J. Roach, A.F.C., to No. 3 Flying Training School, Grantham, 14.12.33, for Engineer duties, vice S/Ldr. C. St. Noble.

Flight Lieutenants : L. C. Bennett, to No. 6 (B) Sqdn., Ismailia, Egypt, 1.12.33. J. D. F. Bruce, to R.A.F. Base, Singapore, 8.12.33. P. MacG. Watt, to No. 607 (County of Durham) (B) Sqdn., Usworth, 10.12.33.

Flying Officers : F. L. White, to Station H.Q., Hal Far, 8.12.33. J. K. Quill, to Station Flight, Duxford, 11.12.33.

Pilot Officers : R. A. C. Carter, to No. 27 (B) Sqdn., Kohat, India, 13.11.33. E. B. C. Davies, to No. 39 (B) Sqdn., Risalpur, India, 13.11.33. T. G. L. Gale, to No. 39 (B) Sqdn., Risalpur, India, 13.11.33. D. J. P. Lee, to No. 60 (B) Sqdn., Kohat, India, 13.11.33. P. de G. H. Seymour, to No. 26 (A.C.) Sqdn., Catterick, 7.12.33.

Stores Branch

Flight Lieutenants : C. W. Gore, to No. 1 (Indian Wing) Station, Kohat, India, 8.12.33. F. R. Lines, to No. 2 Stores (Ammunition) Depot, Altrincham, 11.12.33.

Accountant Branch

Flight Lieutenant G. W. Lynn, to H.Q., R.A.F. Middle East, Cairo., 30.11.33.

Medical Branch

Flight Lieutenant P. J. McNally, to Central Med. Estab., 12.12.33.

Flying Officers : J. S. Carslaw, to Aircraft Depot, India, Karachi, 8.12.33. R. E. W. Fisher, to No. 2 (Indian Wing) Station, Risalpur, 8.12.33. T. C. Macdonald, to R.A.F. General Hospital, Hinaidi, Iraq, 9.12.33.

NAVAL APPOINTMENT

The following appointment has been made by the Admiralty :—

Lieut.-Com.: J. I. Robertson (Flt.-Lt., R.A.F.), re-attached to R.A.F. and appointed to *Victory* for R.A.F. Base, Gosport, for refresher course (December 11), and to *Courageous* and for ffd. in 820 Squadron.

Halton. No. 1 School of Technical Training (Apprentices)—

The following are extracts from the Report by Air Vice-Marshal N. D. K. MacEwer, C.M.G., D.S.O., the Air Officer Commanding, Royal Air Force, Halton, upon the occasion of the Passing-Out of the 23rd Entry of Aircraft Apprentices. The inspection was carried out by Air Marshal Sir H. C. T. Dowding, K.C.B., C.M.G.

Of the 402 boys originally attested :—70 were posted to the Electrical and Wireless School, for training as Electricians and Wireless Operator Mechanics, 2 were granted discharge by purchase, 7 were discharged as "Unlikely to become efficient airmen," 14 were discharged on medical grounds, 1 was remustered to Aircrafthand, 9 were transferred to a junior entry, 12 were transferred from senior entries, leaving 311 to pass-out from No. 1 Apprentices' Wing, Halton.

Before I pass on to the results achieved by this entry, it is gratifying to be able to report that we must go back as far as the entry of September, 1925, to find an entry with less casualties.

The aircraft apprentices of this entry have been trained as follows :—

Fitters, aero engine 141, metal riggers 138, fitters, armourer 18, and coppersmiths and metal workers 14.

As a result of the final examinations :—53 aircraft apprentices, representing 17 per cent. of the entry, have been classified as Leading Aircraftmen ; 218, representing 70 per cent. of the entry, have been classified as Aircraftmen 1st Class ; 30, representing 9·6 per cent. of the entry, have been classified as Aircraftmen 2nd Class ; no aircraft apprentice failed to qualify, and 10 were not examined owing to sickness.

In making a comparison of the passing-out to-day with those of a few years ago, due consideration must be given to the fact that much greater knowledge is now required of a Leading Aircraftman. In spite of this higher standard, the records, although fluctuating from entry to entry, show a gradual upward movement in the percentage of Leading Aircraftmen and Aircraftmen 1st Class.

The educational standard of this entry was fairly high on their arrival. This standard has on the whole been maintained.

The standard of discipline has been very high and well maintained throughout the whole period of training. The smartness and keenness displayed in drill and physical training has been above the average.

Sergeant, Corporal and Leading Apprentices have carried out their duties satisfactorily and there has been great keenness to obtain these appointments.

In regard to sport, this entry has been above the average in the number of apprentices who showed promise. One had the distinction of winning the Boys' Inter-Services Light Weight Boxing Championship.

The health of the entry has been satisfactory. No serious epidemics have occurred.

The passing-out of the 23rd Entry will bring into the Service a number of keen and competent mechanics and good airmen, who I feel sure will make every endeavour to uphold the reputation already gained by the ex-Halton boy, and I take this opportunity of congratulating the whole of the staff on the result of their efforts.

Awards.—The following is a list of the awards :—

Grand Aggregate.—1st Prize : Cpl./App. George Greenley Witty ; *2nd Prize :* Cpl./App. Frank Hollins Buckley ; *3rd Prize :* L/A/App. Cyril Woolnough. *1st Fitter A.E. :* A/App. Rodolphe Broadhurst. *1st Metal Rigger :* L/A/App. Dinsmore William Reid. *1st Coppersmith and Fitter Armourer (combined) :* A/App. John Burgess. *1st Educational Subjects :* Cpl/App. George Greenley Witty.

Cadetships.—Cadetships have been awarded to :—L/A/App. Arthur Reginald Atkins, Cpl./App. Edwin John Bunting, L/A/App. William Harold Kelk.

Lord Wakefield Scholarship.—The Lord Wakefield Scholarship has been awarded to L/A/App. Arthur Reginald Atkins.

Elliott Memorial Prize.—The Elliott Memorial Prize has been awarded to Cpl./App. George Greenley Witty ; A/App. Godfrey Stephen Foad, who tied with the highest number of marks in the General Studies paper at the examination in Educational Subjects.

Royal Air Force Reserve (Officers). 60 Vacancies for Flying Training

The Air Ministry announces :—Approximately 60 vacancies exist for entry into the Royal Air Force Reserve during the next few months for initial training in flying. The vacancies will be filled by direct entrants from civil life. Experience of flying is not necessary as a complete course of flying instruction is given at no cost to the candidate. Applicants, who would be entered into Class A.A.(ii) of the Reserve of Air Force Officers in the rank of Pilot Officer, must not have reached their 25th birthday and must be physically fit and of good education. The initial period of service in the Reserve is 5 years. The instructional course consists of 50 hours' flying which must be carried out in a maximum period of 3 months With good weather, candidates should, however, be able to complete the course in not more than 2 months. Within certain limits, flying instruction may be carried out at times convenient to candidates. Entrants are required to do 10 hours' flying in the second half of their first year of service, Thereafter they must carry out 20 hours' flying annually within a maximum period of 20 days. Entrants are also required to attend a short 4-6 day course at a R.A.F. unit in their second and subsequent years of service. Flying training is carried out at civilian flying schools, at present situated at Bristol, Brough (East Yorks), Hamble (Hants.), and Hatfield (Herts.). The instruction is given by qualified flying instructors of the R.A.F. Reserve and the types of aircraft used are the De Havilland "Tiger Moth," "Avro" "Cadet" and Blackburn "B.2." The syllabus of instruction includes practice in air pilotage, aerobatics, "blind flying," camera gun work and photography. Pay and allowances at R.A.F. rates (totalling approximately £1 a day on entry) are issued during attendance for training and in addition a retaining fee of £25 is issued annually. Copies of A.M. Pamphlet 14 which contains full particulars as to the method of entry into the Reserve and conditions of service, together with the necessary application forms can be obtained from The Secretary, Air Ministry, (S.7 (*c*)), Adastral House, Kingsway, London, W.C.2, on request. Candidates selected for interview are required to attend a selection board at the Air Ministry and to pass a medical examination prior to acceptance. Vacancies also exist in Class A.A. (i) of the Reserve of Air Force Officers for holders of Civil A licences. Candidates may be considered for this Class up to their 28th birthday, and are required to pass a flying test to demonstrate their ability to proceed direct to reserve training. Applications should also be addressed to The Secretary, Air Ministry, as above.

AIRCRAFT COMPANIES' STOCKS AND SHARES

DESPITE the reduction in the volume of business owing to holiday influences, a steady tendency has been maintained by the stock and share market. Sentiment was assisted by the Chancellor of the Exchequer's recent statement as to the favourable Budget position and by the further indications that recovery in general trade conditions is continuing. There has been a good deal of interest in shares of companies identified with the aircraft and allied industries. De Havilland were an outstanding feature, the increase in the dividend from 2½ per cent. to 7½ per cent. being up to best market expectations, and on balance for the month the price of the shares has moved up from 27s. to 37s. 3d. The report issued last week confirms the good recovery in net profits to £63,440. The dividend on the shares, which takes £30,000, is conservative, and permits of £25,000 being placed to reserve and an increase in the carry forward from £2,847 to £6,287. This should, of course, be remembered in connection with the dividend yield on the shares being on the small side. On the other hand, Fairey Aviation, which are little changed on balance for the month, had a sharp set-back last week following the announcement of the dividend, which is maintained at 10 per cent., but is to be paid less tax, instead of tax free as heretofore. This came as a distinct disappointment to the market, but the report and accounts show that, although profits are lower, the company has earned a larger dividend than 10 per cent. and that the policy of putting a good proportion of the profits back into the business is being continued. The work in progress item is not much below the figure in the previous accounts. There has on balance for the month been a good rise in Imperial Airways from 33s. to 38s. 3d., while Hawker Aircraft continued to attract attention, and moved up further from 17s. 6d. to 19s. and the preference from 20s. 7½d. to 21s. 3d. Reference was made in these notes last month to market views as to dividend possibilities of the last-named company. Handley Page preference are a few pence better at 11s. 9d., compared with 11s. 3d. Although "ex" their half-yearly dividend, Armstrong-Siddeley Development preference are little changed, aided by hopes that the forthcoming report will again show good results. A point of interest was a much better tendency in Vickers, which are 9s. against 8s. 1½d. last month, a satisfactory improvement for a share whose nominal value is 6s. 8d. Although the chairman at the last annual meeting was very cautious as to the more immediate outlook, there is a disposition in the market to anticipate that the company has been doing better in recent months and that there are prospects of the next report showing improved profits. Rolls-Royce (77s. 6d. compared with 66s. 3d.) have been prominent throughout the month in response to market views of possibilities of an increased total dividend for the year. D. Napier ordinary have been rather uncertain, but are unchanged on balance. They may attract attention in the first quarter of the New Year, as the report is usually issued in March. The possibility of an eventual return of capital, to which reference was made at the last annual meeting, tends to maintain a good deal of interest in the shares. Brown Brothers moved strongly in favour of holders, and there was active business in British Oxygen, partly on favourable views as to dividend prospects. Petters issues are unchanged. The decision with regard to resumption of dividends on the preference shares is imminent, but the market is prepared for all question of dividend to be left until the results for the year are available.

Name	Class	Nominal Amount of Share £	Last Annual Dividend	Current Week's Quotation
Anglo-American Oil	Deb.	Stk.	5½	102⅛
Armstrong-Siddeley Develop.	Cum. Pref.	£1	6½	22/6xd
Birmingham Aluminium Castg.	Ord.	£1	7½	28/6
Booth (James), 1915	Ord.	£1	15	73/3
Do. do.	Cum. Pref.	£1	7	28/6
British Aluminium	Ord.	£1	5	27/–
Do. do.	Cum. Pref.	£1	6	24/–
British Celanese	Ord.	10/–	Nil	13/10½
British Oxygen	Ord.	£1c	6½	44/–
Do. do.	Cum. Pref.	£1c	6½	26/3xd
British Piston Ring	Ord.	£1	20	71/3
British Thomson-Houston	Cum. Pref.	£1	7	28/9xd
Brown Brothers	Ord.	£1	10	48/9
Do. do.	Cum. Pref.	£1	7½	30/–
Dick (W. B.)	Cum. Pref.	£10	5	117/6
De Havilland Aircraft	Ord.	£1	7½	37/3
Dunlop Rubber	Ord.	c	4	38½
Do. do.	"C" Cum. Pref.	16/–	10	28/9
En-Tout-Cas (Syston)	Def. Ord.	1/–	Nil	–/6
Do. do.	Ptg. Ptd. Ord.	5/–	Nil	2/7½
Fairey Aviation	Ord.	10/–	10	25/4½
Firth (T.) & John Brown	Cum. Pref.	£1	6D	13/–
Do. do.	Cum. Pref.	£1	5*D	12/9
Ford Motor (England)	Ord.	£1	Nil	21/9
Fox (Samuel)	Mt. Deb.	Stk.	5	82½
Goodyear Tyre and Rubber	Deb.	Stk.	6½	104
Handley Page	Ptg. Pref.	8/–	10	11/9
Hawker Aircraft	Ord.	5/–	B	19/–
Do. do.	Red.Cum.Pref.	£1	B	21/3
Hoffmann Manufacturing	Ord.	£1	5	26/9
Do. do.	Cum. Pref.	£1	7½	26/3xd
Imperial Airways	Ord.	£1	5	38/3
Kayser, Ellison	Ord.	£5	1	62/6
Do. do.	Cum. Pref.	£5	6	100/–
Lucas (Joseph)	Ord.	£1	25E	55/–
Napier (D.) & Son	Ord.	5/–	Nil	7/3
Do. do.	Cum. Pref.	£1	7½	23/9xd
Do. do.	Pref.	£1	8A	18/9
Petters	Ord.	£1	Nil	7/6
Do.	Cum. Pref.	£1	7½G	13/9
Roe (A. V.) (Cont. by Armstrong-Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	c	10	77/6
Smith (S.) & Sons (M.A.)	Def. Ord.	1/–	25	5/–
Do. do.	Pt.Pfd. Ord.	£1	14	48/9
Do. do.	Cum. Pref.	£1	7½	28/9
Serck Radiators	Ord.	£1	12½	44/6
"Shell" Transport and Trading	Ord.	£1	7½*	49/4½
Do. do.	Cum. Pref.	£10	5	£12¼
Triplex Safety Glass	Ord.	10/–	25	79/6
Vickers	Ord.	6/6	4	9/–
Do.	Cum. Pref.	£1	5*	22/3
Vickers Aivation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—

* Dividend paid, tax free. c £1 unit of stock. D Last xd. March, 1931.
A Last xd. September, 1931. B Issued this year. G Last xd. July 19, 1932.
E Also 100%, share bonus.

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PUBLICATIONS RECEIVED

Desk Blotter and Diary, 1934. Hawker Aircraft, Ltd., Canbury Park Road, Kingston-on-Thames.

Auf 16,000 Meter: Maine Fahrten in die Stratosphäre. Schweizer Aero-Revue A.G., Oerlikon-Zürich, Switzerland.

Desk Blotter and Diary, 1934. Noakes Brothers, Ltd., 16, New Street Square, London, E.C.4.

Diaries for 1934

Adlard & Son, Ltd., Bartholomew Press, 21, Hart Street, Bloomsbury Square, London, W.C.1.
Armstrong-Siddeley Motors, Ltd., Coventry.
Cellon, Ltd., Kingston-on-Thames.
Harrison & Sons, Ltd., 44-47, St. Martin's Lane, London, W.C.2.
Imperial Airways, Ltd., Airway Terminus, Victoria Station, London, S.W.1.
Vickers (Aviation), Ltd., Vickers House, Broadway, Westminster, London, S.W.1.

1934 Calendars

Armstrong-Siddeley Motors, Ltd., Coventry.
Blackburn Aeroplane & Motor Co., Ltd., Amberley House, Norfolk Street, Strand, London, W.C.2.
Boulton & Paul, Ltd., Norwich.
Bristol Aeroplane Co., Ltd., Filton, Bristol.
Cirrus-Hermes Engineering Co., Ltd., Croydon Aerodrome, Surrey.
W. T. Clarke & Co., Ltd., Silver Street, Bloomsbury, London, W.C.1.
Mullard Wireless Service Co., Ltd., Vauxhall St., Kennington, S.E.11.
Townsends (Builders), Ltd., 24-25, Dean Street, Oxford Street, London, W.1.
Williamson Manufacturing Co., Ltd., Litchfield Gardens, Willesden Green, London, N.W.10.

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28,769. MESSGERATE BOYKOW GES. Apparatus for the automatic operation of the vertical and transverse stablizing of aircraft. (402,225.)

30,298. A.T.S. CO., LTD., R. H. DOBSON and H. N. WYLIE. Structura members for aircraft. (402,236.)

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11,184. E. DASSET. Radial cylinder engines. (402,323.)

14,579. ASKANIA WERKE AKT.-GES. Automatic steering-apparatus for aircraft, etc. (402,345.)

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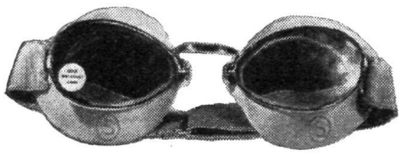

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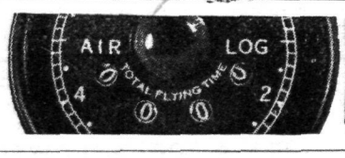

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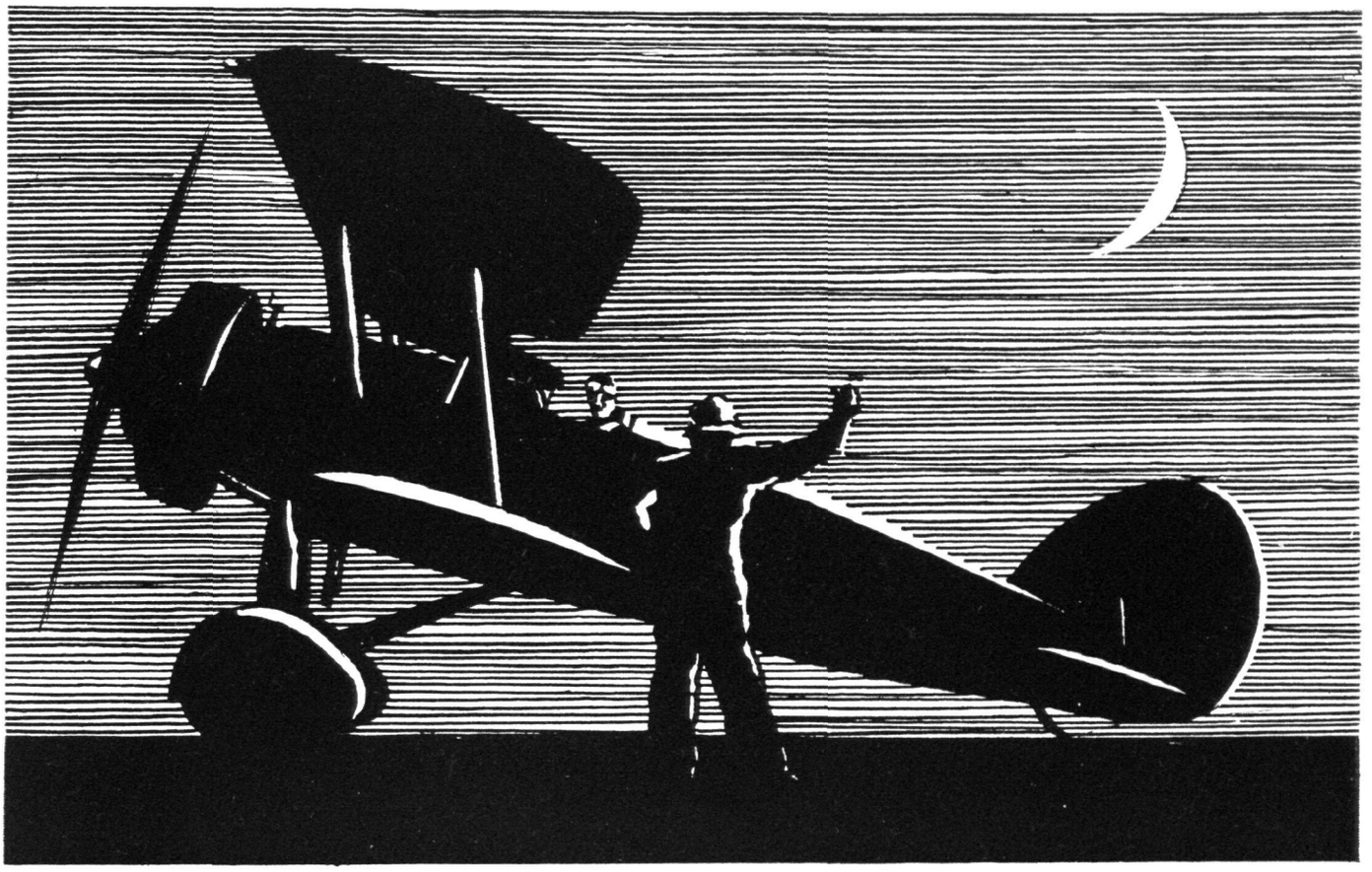

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